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Section 1

General Information

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General Information

Introduction

Vehicle, Engine and Transmission ID and VIN Location, Derivative and Usage



5028742

The vehicle identification number (VIN) plate is the legal identifier of the vehicle. The VIN plate is located on the upper left corner of the instrument panel. The VIN number can be seen through the windshield from the outside of the vehicle:

Vehicle Identification Number (VIN) System

Position	Definition	Character	Description
1	Country of Origin	1	United States
2	Manufacturer	H	Navistar, Inc.
3	Vehicle Brand/Type	A	Chevrolet Incomplete
4–5	Make/Model/Series/Type	KH	GM GM515 GM Conventional SFA 4x2
		KJ	GM GM515 GM Conventional SFA 4x4
6–7	Engine Type	PV	RPO L5D - Engine Diesel, 8 Cyl, 6.6L, DI, V8, Turbo, Duramax, GEN 5, VAR. 3
8	GVWR/Brake System	H	Class 4: 14,001 – 16,000 lbs./Hydraulic
		K	Class 5: 16,001 – 19,500 lbs./Hydraulic
		M	Class 6: 19,501 – 26,000 lbs./Hydraulic
9	Check Digit	0~9,X	Calculated by POMS

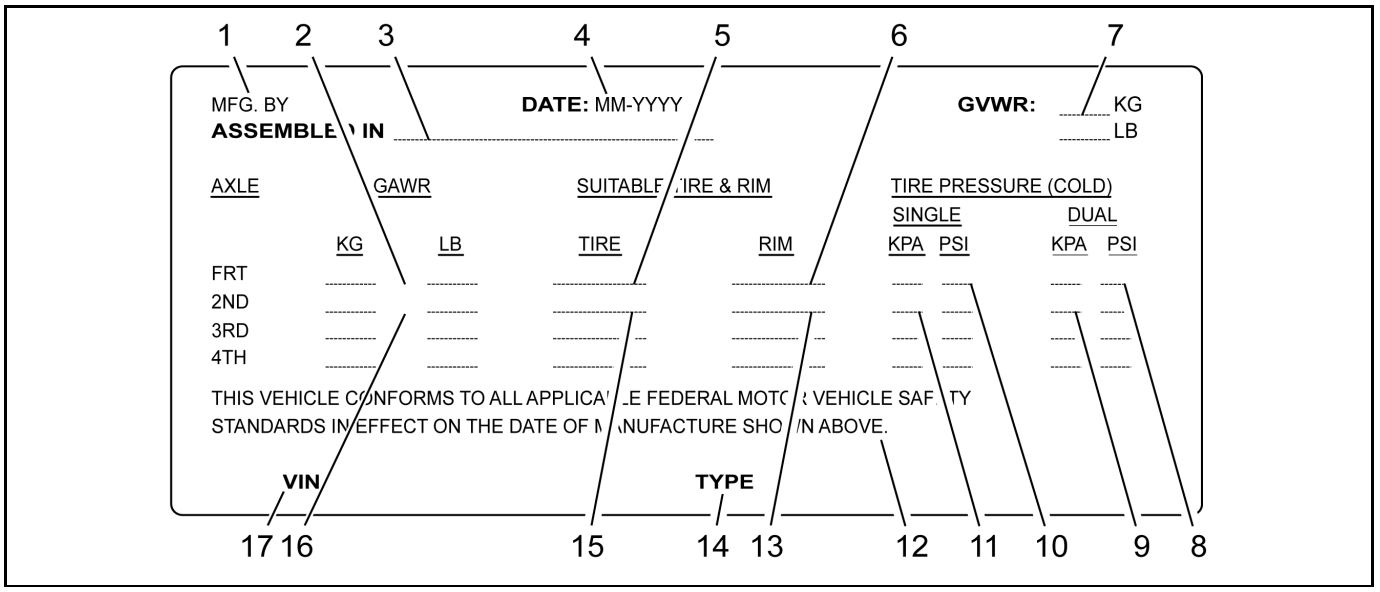
Vehicle Identification Number (VIN) System (cont'd)

Position	Definition	Character	Description
10	Model Year	M	2021
11	Plant Location	H	Springfield, Ohio
12–17	Plant Sequence Number	—	Plant Sequence Number

6.6L (L5D) Engine ID and VIN Derivative Location

Engine Identification

Vehicle Certification Label



4991554

Vehicle Certification Label

Callout	Description
A vehicle-specific Certification label is attached to the driver-side door frame and displays the following assessments:	
1	Name of Manufacturer
2	Gross Weight Rating of the Front Axle
3	Location Vehicle was Assembled In
4	Final Date of Manufacture (Month and Year MM/YY) Date of manufacture is to reflect the date that the vehicle is counted as built. In those cases where a replacement label is needed, the replacement label should reflect the actual build date not the date of replacement.
5	Tire Size Front Axle
6	Rim Size Front Axle
7	Maximum Gross Vehicle Weight Rating (GVWR)
8	Tire Pressure Front Axle Dual (Cold)
9	Tire Pressure Rear Axle Dual (Cold)
10	Tire Pressure Front Axle Single (Cold)
11	Tire Pressure Rear Axle Single (Cold)
12	Certification Statement
13	Rim Size Rear Axle
14	Vehicle Class Type (Pass Car, etc.)
15	Tire Size Rear Axle
16	Gross Weight Rating of the Rear Axle
17	Vehicle Identification Number (VIN)

RPO Code List

The following table provides the description of the Regular Production Option (RPO) codes that are available on the vehicle. The vehicle's RPO list is printed on the Service Parts Identification Label.

RPO	Description
005	RATIO-4.56 (4 5/9)
008	RATIO-4.88
01U	PRIMARY COLOR-EXTERIOR, SPECIAL (02)
02U	PRIMARY COLOR-EXTERIOR, SPECIAL, CHART NOT REQUIRED
066	RATIO-4.10 (4 1/10)
092	RATIO-4.3
1LT	PACKAGE-LT OPTION 1
1WT	PACKAGE-WT OPTION 1
379	SEAT BELT COLOR-ORANGE (02)
3F9	SEAT BELT COLOR-RED (01)
4AA	INTERIOR TRIM-JET BLACK
4D7	INTERIOR TRIM-JET BLACK/DK ASH
5D1	BUMPER FRT-PAINTED GRAY
5DX	PROVISIONS-ELEC - UPFITTER, REAR OF CAB
5DY	PROVISIONS-ELEC - UPFITTER, REAR OF FRAME
5H1	KEY-SINGLE KEY SYSTEM, 2 SPARE KEYS
5HP	KEY-SINGLE KEY SYSTEM, 6 SPARE KEYS (SEO)
5P0	PROVISIONS-ENGINE SHUTDOWN
5T5	SEAT OVERRIDE-(SEO)
6E2	CYLINDER UNIT-SINGLE KEY SYSTEM, CODED, VAR. 1 (SEO)
6E8	CYLINDER UNIT-SINGLE KEY SYSTEM, CODED, VAR 2 (SEO)
6Y5	ORNAMENTATION-EXTR, EMBLEM, NON-INSTALLED
719	SEAT BELT COLOR-BLACK (10)
7Y7	BATTERY-1100 CCA, DUAL BATTERY SYSTEM
7Y8	BATTERY-1300 CCA, DUAL BATTERY SYSTEM
7Y9	BATTERY-2250 CCA, THREE BATTERY SYSTEM
8E4	FUEL-ADDITIONAL - 5 GALLONS
8E8	BUMPER FRT-PAINTED, BLACK
8F2	ORNAMENTATION-NONE
8H5	BUMPER FRT-NONE
8X8	LABEL INFORMATION-LABEL, FASTEN SEAT BELTS (SEO)
9B9	GOVERNOR-VEHICLE TOP SPEED LIMIT - 70 MPH (SEO)
9C2	GOVERNOR-VEHICLE TOP SPEED LIMIT - 65 MPH (SEO)
9D4	GOVERNOR-VEHICLE TOP SPEED LIMIT - 55 MPH (SEO)
9D6	GOVERNOR-VEHICLE TOP SPEED LIMIT - 79 MPH (SEO)
9D7	GOVERNOR-VEHICLE TOP SPEED LIMIT - 75 MPH (SEO)
9D9	MIRROR I/S R/V-(NONE)
9G8	EQUIPMENT-DAYTIME RUNNING LAMP & HEADLAMPS CONTROL - NONE (SEO) (DO NOT USE AFTER MY23)
9L3	TIRE SPARE-NONE
9L7	EQUIPMENT-ACSRY WRG JUNC BLK
9S1	TRIM OVERRIDE-VINYL COVERING, SEAT (2 PASSENGER) (SEO)
9U3	TRIM OVERRIDE-CLOTH COVERING, SEAT (2 PASSENGER) (SEO)
9V5	COLOR-WOODLAND GREEN (SEO)
9W3	COLOR-WHEATLAND YELLOW, LEAD FREE (SEO)
9W4	COLOR-TANGIER ORANGE, LEAD FREE (SEO)
A31	WINDOW-POWER OPERATED, ALL DOORS (DO NOT USE ON NEW/MAJOR PROGRAMS)
A52	SEAT-FRT BENCH
A68	SEAT RR-SPLIT, FOLDING
A95	SEAT-FRT BKT, HIGH BACK, DRIVER & PASS RECL
AAC	PARTS PKG-SHIPPED LOOSE
ACO	IDENTIFICATION-ACCESSORY CATALOG OFFERING
AE7	SEAT-FRT SPLIT, DRIVER, PASS
AG1	ADJUSTER FRT ST-POWER, MULTI-DIRECTIONAL, DRIVER (DO NOT USE ON NEW PROGRAMS AFTER MY18)
AKO	WINDOW TYPE-PRIVACY
AKP	WINDOW TYPE-SOLAR ABSORBING
ANC	SALES PACKAGE-SHUTTLE BUS
ANK	SALES PACKAGE-NON-CONFORMING SCHOOL BUS
APL	SEAT PASSENGER-(NONE)
AQQ	LOCK CONTROL, ENTRY-REMOTE ENTRY, EXTENDED RANGE (MY 09 AND FUTURE)
ATZ	SEAT RR-NONE
AU3	LOCK CONTROL-SIDE DR, ELEC
AY0	RESTRAINT SYSTEM-SEAT, INFLATABLE, DRIVER & PASS FRT, SEAT SIDE, ROOF SIDE
AY1	RESTRAINT SYSTEM-SEAT, INFLATABLE, DRIVER ONLY FRT, SEAT SIDE, ROOF SIDE
BG9	COVERING FLOOR-RUBBER
BTN	EQUIPMENT-POST BATTERY, THREADED
BTV	REMOTE START-VEHICLE

RPO	Description
C49	DEFOGGER-RR WINDOW, ELECTRIC
C5B	GVW RATING-15,000 LBS
C5D	GVW RATING-22,500 LBS (10,206 KG)
C67	HVAC SYSTEM-AIR CONDITIONER FRT, ELECTRONIC CONTROLS
C7P	GVW RATING-16,000 LBS
C7R	GVW RATING-16,500 LBS
C7Y	GVW RATING-14,001 LBS
C99	SWITCH-INFL RST I/P MDL MAN SUPPRESSION
C9U	GVW RATING-22,940 LBS (10,387 KG)
CV3	COUNTRY-MEXICO
D07	CONSOLE-FRT COMPT, FLOOR, CUSTOM
DB9	GVW RATING-23000 LBS (10433 KG)
DD4	GVW RATING-17,000 LBS
DD5	GVW RATING-21,000 LBS
DD7	GVW RATING-23,500 LBS
DD8	MIRROR I/S R/V-LT SENSITIVE
DF2	MIRROR O/S-LH & RH, WIDE LOAD, FOLDING, STAINLESS STEEL
DGD	MIRROR O/S-MAN ADJ, MAN FOLD, FLAT/ DRVR, FLAT/PASS, WFOV DRVR/PASS, 102" (SEO)
DGL	MIRROR O/S-MAN ADJ, MAN FOLD, FLAT/ DRVR, FLAT/PASS, WFOV DRVR/PASS, 96" (SEO)
DH6	MIRROR I/S FRT VAN-LH & RH, SUNSHADE, ILLUM (DO NOT USE NEXT NEW MAJOR)
DP9	MIRROR PROVISIONS-HOUSING, CHROME
DPN	MIRROR O/S-LH & RH, WIDE LOAD, VERTICAL GLASS, MAN EXTENDING,MAN FOLDING, HEATED, TURN SIG IND, REMOTE CONTROL
DRZ	MIRROR I/S R/V-LT SENSITIVE, FULL VIDEO DISPLAY
E01	STEPS-ASSIST
E0N	STEPS-ASSIST ALUMINUM
E20	HANDLE O/S DOOR-CHROME
ED5	WHEELBASE-201 INCH
ED9	WHEELBASE-165 INCH
EF7	COUNTRY-UNITED STATES OF AMERICA (USA)
EM1	WHEELBASE-199 INCH
EQB	WHEELBASE-219 INCH
ER2	WHEELBASE-189 INCH
F0C	AXLE END FRAME-49 INCH
F0D	AXLE END FRAME-63 INCH
F0G	AXLE END FRAME-83 INCH
F0I	AXLE END FRAME-75 INCH
F0K	AXLE END FRAME-91 INCH

RPO	Description
F59	STABILIZER SHAFT FRT-
F95	SUSPENSION FRONT-6,000 LB, TAPERED LEAF
FBC	WHEELBASE-243 INCH
FF3	SEAL-OIL, WHEEL FRT
FG0	HUB-FRONT, OIL FILLED SYNTHETIC
FHX	VEHICLE FUEL-DIESEL B20
FK6	SUSPENSION FRONT-7,000 LB, TAPERLEAF, I-BEAM
FN1	AXLE REAR-10,000 LB (4,536KG)
FNP	FENDERS-FRONT EXTENSIONS - PAINTED
FNV	WHEELBASE-175 INCH
FNX	FENDERS-FRONT EXTENSIONS
FPF	EQUIPMENT-EMISSION-DIESEL DPF MANUAL REGENERATION
FPN	WHEELBASE-231 INCH
FQT	WHEELBASE-141 INCH
FRP	WHEELBASE-235 INCH
FSN	SUSPENSION FRONT-8,000 LB (3,629 KG), TAPERED LEAF
FTA	AXLE FRONT-7,000 LB., FRONT NON DRIVING
FTB	AXLE FRONT-7,500 LB., FRONT DRIVING
FTD	AXLE FRONT-6,000 LB., FRONT NON DRIVING
FTL	AXLE FRONT-8,000 LB., FRONT NON DRIVING
FTN	LUBRICANT-FRT AXLE, SYNTHETIC
FTO	LUBRICANT-RR AXLE, SYNTHETIC
FTV	SUSPENSION FRONT-7,500 LB, TAPERED LEAF, SHACKLE TYPE, PARABOLIC SPRING
FU7	SUSPENSION REAR-15,500 LB (7,031 KG), MULTILEAF
G1K	PRIMARY COLOR-EXTERIOR, SACR'E BLUE MET(409Y)
G2X	PRIMARY COLOR-EXTERIOR, HAVANA MET-1 (439C)
G40	SUSPENSION REAR-12,000 LB, AIR
G68	SHOCK ABSORBERS-RR, HD, TRUCK
G7C	PRIMARY COLOR-EXTERIOR, PULL ME OVER RED SOLID (130X)
G80	AXLE POSITRACTION-LIMITED SLIP
G86	AXLE-LIMITED SLIP
G9K	PRIMARY COLOR-EXTERIOR, SATIN STEEL GRAY MET-3 (464C)
GA0	PRIMARY COLOR-EXTERIOR, SOME KINDA BLUE MET -1 (619D)
GAN	PRIMARY COLOR-EXTERIOR, SWITCHBLADE SILVER MET (G) 636R
GAZ	PRIMARY COLOR-EXTERIOR, SUMMIT WHITE (G) 8624

RPO	Description
GB8	PRIMARY COLOR-EXTERIOR, BLACK MEET KETTLE MET (384A)
GBA	PRIMARY COLOR-EXTERIOR, BLACK (G) 8555
GH5	EQUIPMENT ADDITIONAL-CANADA
GJI	PRIMARY COLOR-EXTERIOR, DARK SHADOW MET -1 (626D)
GL4	AXLE REAR-11,000 LB (4,990 KG)
GP1	SUSPENSION REAR-13,500 LB, AIR
GP8	SUSPENSION REAR-15,500 LB, AIR
GPA	PRIMARY COLOR-EXTERIOR, GASOLINE MET-2 (457B)
GR3	SUSPENSION REAR-11,000 LB (4,990 KG), MULTILEAF
GR4	SUSPENSION REAR-13,500 LB, MULTILEAF
GS6	PRIMARY COLOR-EXTERIOR, SCORPION MET -1 (634D)
GZG	GVW RATING-19,500 LBS
GZH	GVW RATING-21,500 LBS
GZJ	GVW RATING-18,000 LBS
GZX	GVW RATING-17,500 LBS
H0U	INTERIOR TRIM CONFIG-CLOTH, LEVEL 2, JET BLACK
H2Q	INTERIOR TRIM CONFIG-VINYL, LEVEL 1, JET BLACK /DK ASH
H2R	INTERIOR TRIM CONFIG-CLOTH, LEVEL 1, JET BLACK/ DK ASH
H2S	INTERIOR TRIM CONFIG-CLOTH, LEVEL 2, JET BLACK / DK ASH
HD1	AXLE REAR-15,000 LB (6,804 KG), DANA S130
HD2	AXLE REAR-13,500 LB (6,124 KG), DANA S110
IO3	RADIO-INFOTAINMENT SYSTEM - BASE HMI
IO5	RADIO-INFOTAINMENT SYSTEM - UPLEVEL HMI, ENHANCED CONNECTIVITY
IO6	RADIO-INFOTAINMENT SYSTEM - UPLEVEL HMI, ENHANCED CONNECTIVITY, EMBEDDED NAVIGATION
IOB	RADIO-INFOTAINMENT SYSTEM - MIDLEVEL HMI, MIDLEVEL CONNECTIVITY
ITT	MARKET BRAND-INTERNATIONAL TRUCK
J21	ENGINEERING YEAR-2021
J27	AXLE REAR-15,500LB
J48	BRAKE SYSTEM-HYDRAULIC, HEAVY DUTY STSTEM, ABS (DNU NEXT NEW MAJOR)
J69	BRAKE PARKING-MECHANICALLY OPERATED
JG1	SHAFT-PROP, ALUMINUM

RPO	Description
JL1	BRK APL CTRL FEATURE-INTEGRATED TRAILER BRAKE
JPY	AIR DRYER-HEATED
JPZ	VALVE-AIR SUSPENSION AIR RELEASE
JTR	PROVISIONS-TAIL LAMP - WIRING HARNESS SPECIAL (DO NOT USE, SEE BFO)
K05	HEATER ENG-BLOCK
K34	CRUISE CONTROL-AUTOMATIC, ELECTRONIC
K40	ENGINE BRAKE-EXHAUST
K4C	CHARGER-INDUCTIVE PORTABLE WIRELESS DEVICE
KA1	HEATER SEAT FRT-DRVR & PASS
KBG	SHIFT CONTROL-AUTOMATIC TRANSMISSION, FUEL SENSE BASIC
KBK	SHIFT CONTROL-AUTOMATIC TRANSMISSION, PERFORMANCE
KG4	GENERATOR-150 AMP
KHB	GENERATOR-150 AMP AND 220 AMP, DUAL
KI4	RECEPTACLE I/P-ELECTRICAL, 110 VOLT
KL6	PROVISIONS-TAIL LAMP, LOCATION INSIDE OF FRAME (DO NOT USE, SEE BFO)
KT0	HOSE-HEATER, SILICONE
KUD	CLAMP-HEATER HOSE, BELLEVILLE WASHER TYPE
KUT	AIR COMPRESSOR-ACCESSORY DRIVE
KW5	GENERATOR-220 AMP
L5D	ENGINE-DIESEL, 8 CYL, 6.6L, DI, V8, TURBO, DURAMAX, GEN 5, VAR. 3
LVA	GOVERNOR-VEHICLE TOP SPEED LIMIT - 60 MPH (SEO)
MA6	TRANSMISSION-AT6, A1700PTS
MB6	TRANSMISSION-AT6, A2700PTS
MBV	TRANSMISSION-AT6, A2750RDS
MBW	TRANSMISSION-AT6, A2750MH
MBX	TRANSMISSION-AT6, A2750HS
MBY	TRANSMISSION-AT6, A2750EVS
ME0	TRANSMISSION-AUTO 6 SPD, ALLISON, A1750MH, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MF0	TRANSMISSION-AUTO 6 SPD, ALLISON, A2700MH, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MG0	TRANSMISSION-AUTO 6 SPD, ALLISON, A2700EVS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MH1	TRANSMISSION-AUTO 6 SPD, ALLISON, A1700EVS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MHV	TRANSMISSION-AUTO 6 SPD, ALLISON, A1750EVS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1

RPO	Description
MI0	TRANSMISSION-AUTO 6 SPD, ALLISON, A1750RDS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MIA	TRANSMISSION-AUTO 6 SPD, ALLISON, A2700RDS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MIU	TRANSMISSION-AUTO 6 SPD, ALLISON, A1700RDS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MIX	TRANSMISSION-AUTO 6 SPD, ALLISON, A1700MH, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MJ0	TRANSMISSION-AUTO 6 SPD, ALLISON, A1750HS, 3.10 1ST 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH GEN 1
MTZ	PROVISIONS-TAIL LAMP, LOCATION OUTSIDE OF FRAME (DO NOT USE, SEE BFO)
MWA	TRANSMISSION-AUTO 6 SPD, ALLISON, A1700HS, 3.10 1ST, 1.80 2ND, 1.40 3RD, 1.00 4TH, 0.70 5TH, 0.60 6TH, GEN 1
MWB	TRANSMISSION-AUTO 6 SPD, ALLISON, A2700HS, 3.10 1ST,1.80 2ND,1.40 3RD, 1.00 4TH,0.70 5TH,0.60 6TH, GEN 1
N12	EXHAUST SYSTEM-REAR EXIT
N2L	FUEL TANK-REAR TANK 40 GAL (151L)
N33	STEERING COLUMN-TILT TYPE
N4C	CERTIFICATION-EMISSION, USA 50 STATE
N4E	EMISSION SYSTEM-USA, 50 STATE
NAV	PLANT CODE-NAVISTAR, SPRINGFIELD, OH, USA
NK5	STEERING WHEEL-STANDARD
NP5	STEERING WHEEL-LEATHER WRAPPED
NPJ	EXHAUST SYSTEM-SIDE EXIT, LH
NPK	EXHAUST SYSTEM-SIDE EXIT, RH
NPR	EXHAUST SYSTEM-SIDE EXIT, RH, LOCATION BEHIND REAR WHEEL
NQF	TRANSFER CASE-ELECTRIC SHIFT CONT, TWO SPEED, ALUM
NSQ	FUEL TANK-DUAL, FRONT 25 GAL (94.6L), REAR 40 GAL (151L)
NVK	FUEL TANK-FRONT, 25 GAL (94.6L)
NXG	FUEL-ADDITIONAL - 20 GALLON
NXO	FUEL-ADDITIONAL- 40 GALLONS
NZZ	SALES PACKAGE-SKID PLATE, "OFF ROAD" SPORT
P0D	GUARD-GRILLE SCREEN - INSECT PROTECTION
P0E	GUARD-GRILLE SCREEN - EMBER
PD7	WHEEL SPARE-(NONE)
PTO	ENGINE CONTROL-POWER TAKE OFF (PTO) CONTROLS
PTX	ENGINE CONTROL-POWER TAKE-OFF (PTO), CONTROLS - NONE
PWQ	WHEEL-19.5 X 6.75, J, STEEL, DESIGN 1
PWR	WHEEL-19.5 X 6.75, J, STEEL, DESIGN 2
PWS	WHEEL-19.5 X 6.75, J, STEEL, DESIGN 3
PWV	WHEEL-19.5 X 6.75, J, ALUMINUM, DESIGN 1
PWY	WHEEL SPARE-19.5 X 6.75, J, STEEL, DESIGN 1
PWZ	WHEEL SPARE-19.5 X 6.75, J, ALUMINUM, DESIGN 1, FRONT
PXB	WHEEL SPARE-19.5 X 6.75, J, ALUMINUM, DESIGN 1, REAR
Q91	CAP-VALVE, TIRE, AIR-THRU DESIGN 1
Q92	CAP-VALVE, TIRE, AIR-THRU DESIGN 2
RDI	ACCESSORY-KEYLESS ENTRY
RWI	ACCESSORY-BODY SIDE MOLDINGS - CHROME
RWK	ACCESSORY-BODY SIDE MOLDINGS - PAINTED
RWR	ACCESSORY-CAMERA - REAR VISION
RY7	ACCESSORY-DOOR HANDLES - ALTERNATE FINISH 1
S0P	ACCESSORY-INSERT - FLOOR CONSOLE
S6M	ACCESSORY-RADIO KIT - NAVIGATION
S6P	ACCESSORY-REMOTE START KIT
S6W	ACCESSORY-SEAT COVER - MUDDER (PROTECTIVE)
S6Z	ACCESSORY-SEAT COVER - TAILORED - ALTERNATE MATERIAL
SFJ	ACCESSORY-WINDOW SHADES - REFLECTIVE
SFV	ACCESSORY-WIRELESS NETWORK INTERFACE MODULE
SFW	CALIBRATION-BACK UP ELECTRICAL ALARM (SEO)
SIF	ACCESSORY-RSE - PORTABLE MEDIA CONNECTIVITY PACKAGE
SYT	ACCESSORY-SILL PLATES - ALTERNATE FINISH
T3A	BUMPER PROVISIONS-FRONT, 4" EXTENSION
T3U	LAMP FRT FOG-FRT FOG
T3V	LAMP-CHMSL - CENTER HIGH MOUNT STOP LIGHT
TG5	PLAYER-COMPACT DISC AND MP3
TGK	COLOR COMBINATION-SOLID, SPECIAL PAINT
TR1	LAMP-TAIL & STOP (DO NOT USE, SEE BFO)
TRW	PROVISIONS-LAMP, ROOF MOUNTED
U01	LAMP-FIVE, ROOF MARKER, TRUCK
U04	HORN-SINGLE NOTE
U05	HORN-DUAL
U19	SPEEDOMETER-INST, KILO & MILES, KILO ODOMETER

RPO	Description
U2J	DIGITAL AUDIO SYSTEM-S-BAND - NONE
U2K	DIGITAL AUDIO SYSTEM-S-BAND
U73	ANTENNA-FIXED, RADIO
UDA	COMMUNICATION SYSTEM-VEHICLE, DEACTIVATED
UDC	DISPLAY INSTRUMENT-DRIVER INFO ENHANCED (ONE COLOR GRAPHIC)
UDD	DISPLAY INSTRUMENT-DRIVER INFO ENHANCED (MULTI COLOR STANDARD GRAPHIC)
UE0	COMMUNICATION SYSTEM-VEHICLE - NONE (DO NOT USE NEXT NEW MAJOR)
UE1	COMMUNICATION SYSTEM-VEHICLE, ONSTAR
UEA	TAIL LAMP-(NONE) (DO NOT USE, SEE BFO)
UEH	PROVISIONS-ELECTRICAL SWITCH BANK (SEO)
UF3	SWITCH-HIGH IDLE
UGE	LAMP-RR TAIL, LED (DO NOT USE, SEE BFO)
UH4	SWITCH-HEADLINER SWITCH BANK
UK3	CONTROL-STEERING WHEEL, ACCESSORY
UMN	SPEEDOMETER-INST, MILES & KILO, MILES ODOMETER
UNL	EQUIPMENT-AUX, 3' FRONT HEAD/ TURN LAMP
UQ3	SPEAKER SYSTEM-ENHANCED AUDIO
UQ5	SPEAKER SYSTEM-4, DUAL FRT DR MTD, DUAL EXTD RGE QTR MNTD
UTJ	THEFT DETERENT-ELECTRICAL, UNAUTHORIZED ENTRY
UTQ	ALARM, HORN-CONTENT THEFT DETERENT, DISABLED (SEO)
UVC	VISION-REAR VIEW, MONO, ANALOG
UY7	WIRING HARNESS-TRUCK TRAILER, HD
UZF	ALARM B/U-ELECTRICAL,
V22	GRILLE-RADIATOR, CHROME
V23	GUARD-GRILLE SCREEN - STONE PROTECTION
V33	TOOL KIT-ROAD, EMERGENCY
V46	BUMPER FRT-CHROME
V76	HOOK-TOW
V8C	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - NO CERT STATEMENT
V8D	VEHICLE STATEMENT-VEHICLE LABEL CONTENT - U.S. FMVSS
VBJ	ACCESSORY-UNDERSEAT STORAGE
VK3	LICENSE PLATE FRONT-FRT MOUNTING PKG
VKW	ACCESSORY-ORGANIZER - FRONT CONSOLE

RPO	Description
VKY	ACCESSORY-DOOR HANDLES - ALTERNATE FINISH - CHROME
VND	GOVERNOR-VEHICLE TOP SPEED LIMIT - 50 MPH (SEO)
VT7	OWNERS MANUAL-ENGLISH LANGUAGE
VTG	ACCESSORY-INTERIOR TRIM KIT
VTS	OWNERS MANUAL-SPANISH LANGUAGE
VV4	COMMUNICATION EQUIP-MOBILE INTERNET CONNECTIVITY
VWX	GRILLE-BASE VEHICLE
VXT	VEHICLE TYPE-INCOMPLETE
VYU	PROVISIONS-SNOW PLOW PREP
WC2	SALES PACKAGE-RENTAL SALES PACKAGE
WFZ	SALES PACKAGE-LEASE SALES PACKAGE
WMU	VIN MODEL YEAR-2021
WN9	PROCESSING-SPECIAL DELIVERY REQUSTED, NOT LEAD UNIT
WOJ	ACCESSORY-DOOR COVER - PET PROTECTOR - DESIGN 1
WRD	WIRING PROVISIONS-UPFITTER
X88	MARKET BRAND-CHEVROLET
XDK	TIRE FRONT-225/70R19.5 G 126/128 L BW HWY GDY
XDL	TIRE FRONT-225/70R19.5 G 126/128 N BW HWY CTL
XDV	TIRE FRONT-225/70R19.5 H 130/128 L BW HWY CTL
XDY	TIRE FRONT-225/70R19.5 G 126/128 N BW TL GDY
XHD	TIRE FRONT-225/70R19.5 G 128 N BW TRN CTL
XL7	FREQUENCIES RATING-315 MHZ, LONG DISTANCE
YAL	TIRE REAR-225/70R19.5 G 126/128 L BW HWY GDY
YAM	TIRE REAR-225/70R19.5 G 126/128 N BW HWY CTL
YAO	TIRE REAR-225/70R19.5 G 126/128 N BW TL GDY
YAP	TIRE REAR-225/70R19.5 H 130/128 L BW HWY CTL
YE9	PACKAGE, CONVENIENCE-COMFORT & DECOR LEVEL #3
YF2	SALES PACKAGE-AMBULANCE UPFITTER
YHD	TIRE REAR-225/70R19.5 G 128 N BW TRN CTL
YM8	IDENTIFICATION-LIMITED PERSONALIZATION OPTION (LPO)
ZBC	TIRE SPARE-225/70R19.5 H 130/128 L BW HWY CTL
ZBK	TIRE SPARE-225/70R19.5 G 126/128 L BW HWY GDY

RPO	Description
ZBP	TIRE SPARE-225/70R19.5 G 126/128 N BW TL GDY
ZBR	TIRE SPARE-225/70R19.5 G 126/128 N BW HWY CTL
ZHD	TIRE SPARE-225/70R19.5 G 128 N BW TRN CTL
ZY1	COLOR COMBINATION-SOLID
ZY2	COLOR COMBINATION-TWO TONE
ZY3	COLOR COMBINATION-TWO TONE, SPECIAL
ZY4	COLOR COMBINATION-TWO TONE, DELUXE

Section 2

Body Systems

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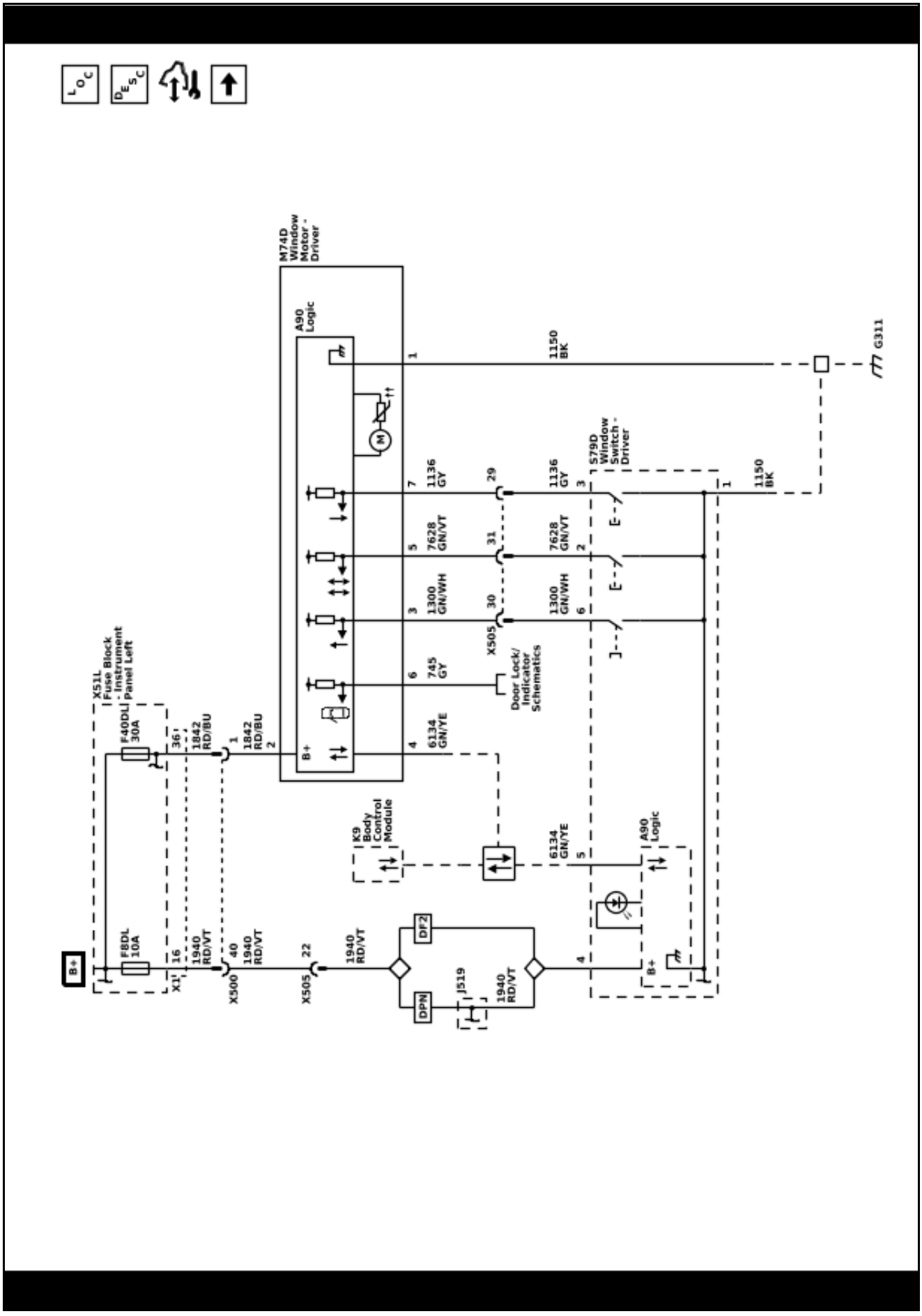
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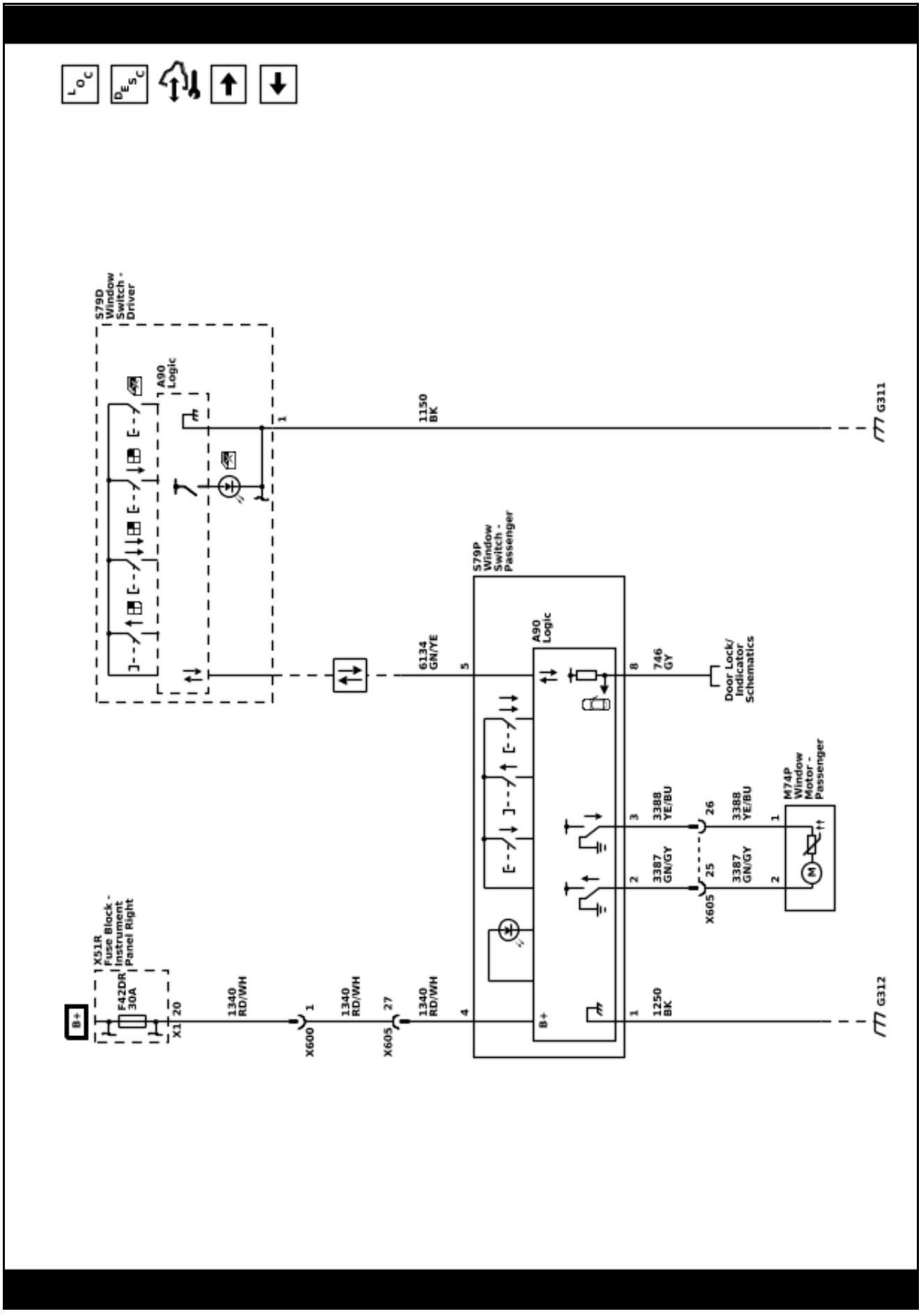
Fixed and Moveable Windows

Schematic and Routing Diagrams

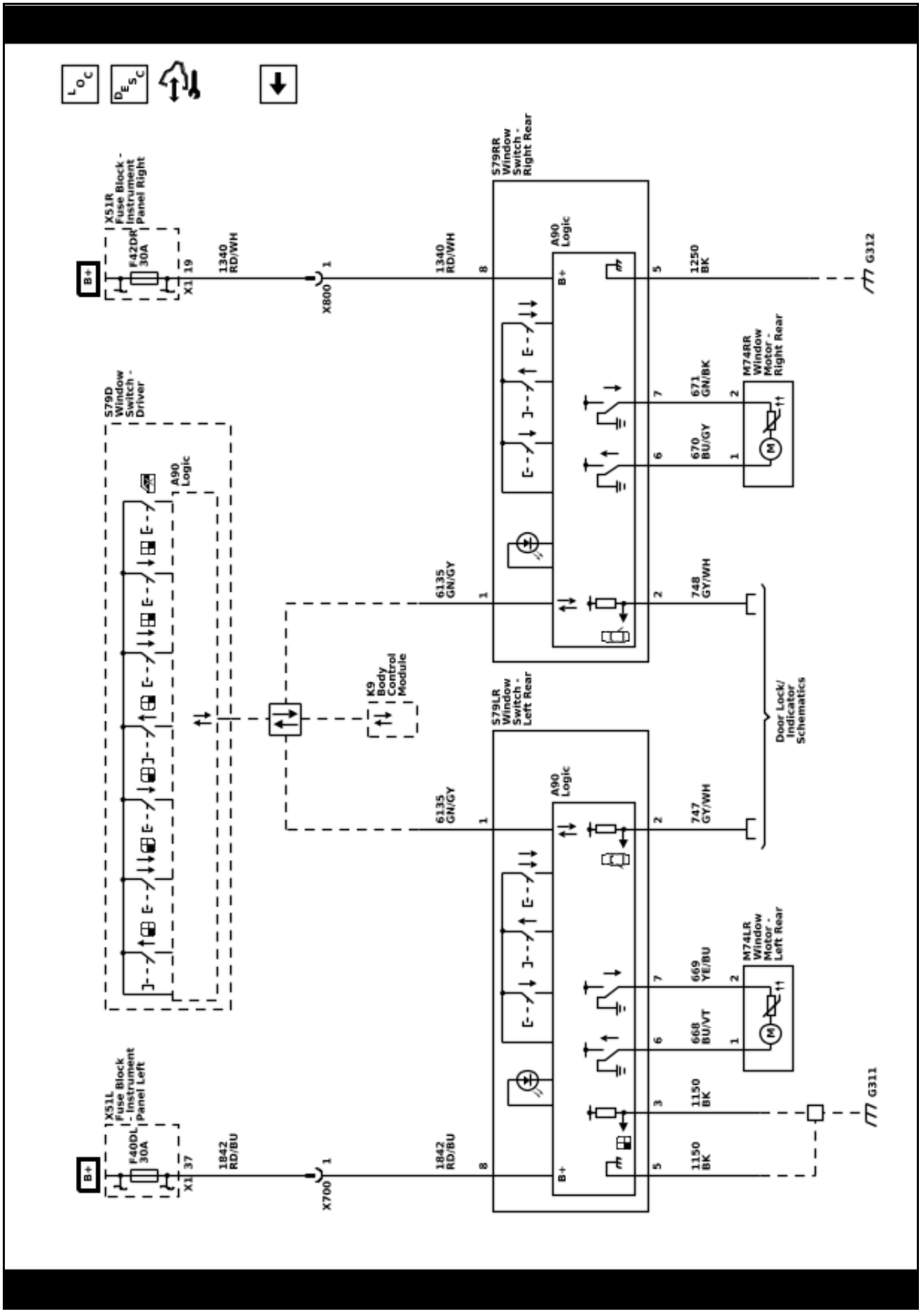
Moveable Window Schematics (Driver Door (A31))



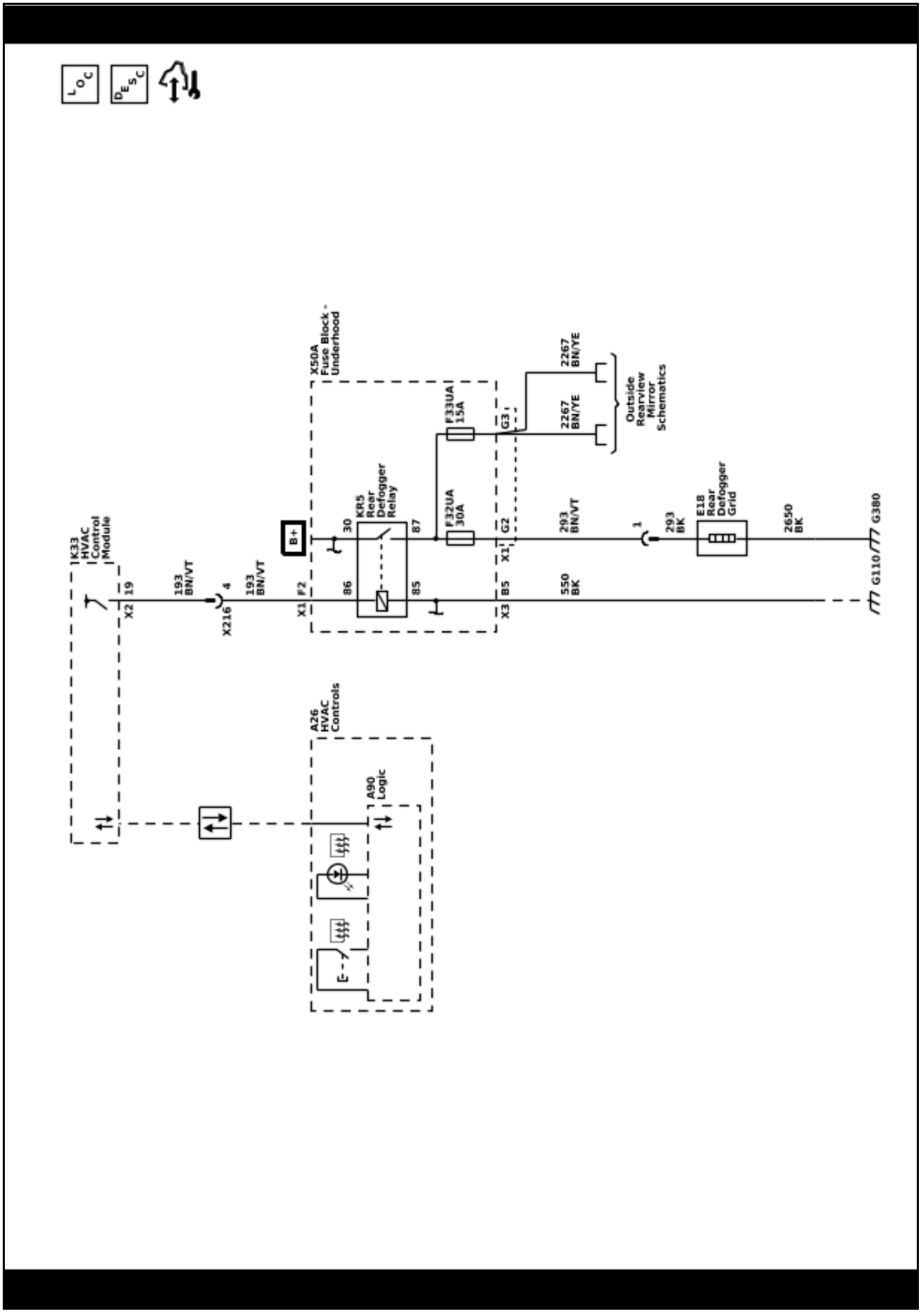
Moveable Window Schematics (Passenger Door (A31))



Moveable Window Schematics (Rear Doors (Crew Cab))



Defogger Schematics (Defogger (C49/DPN))



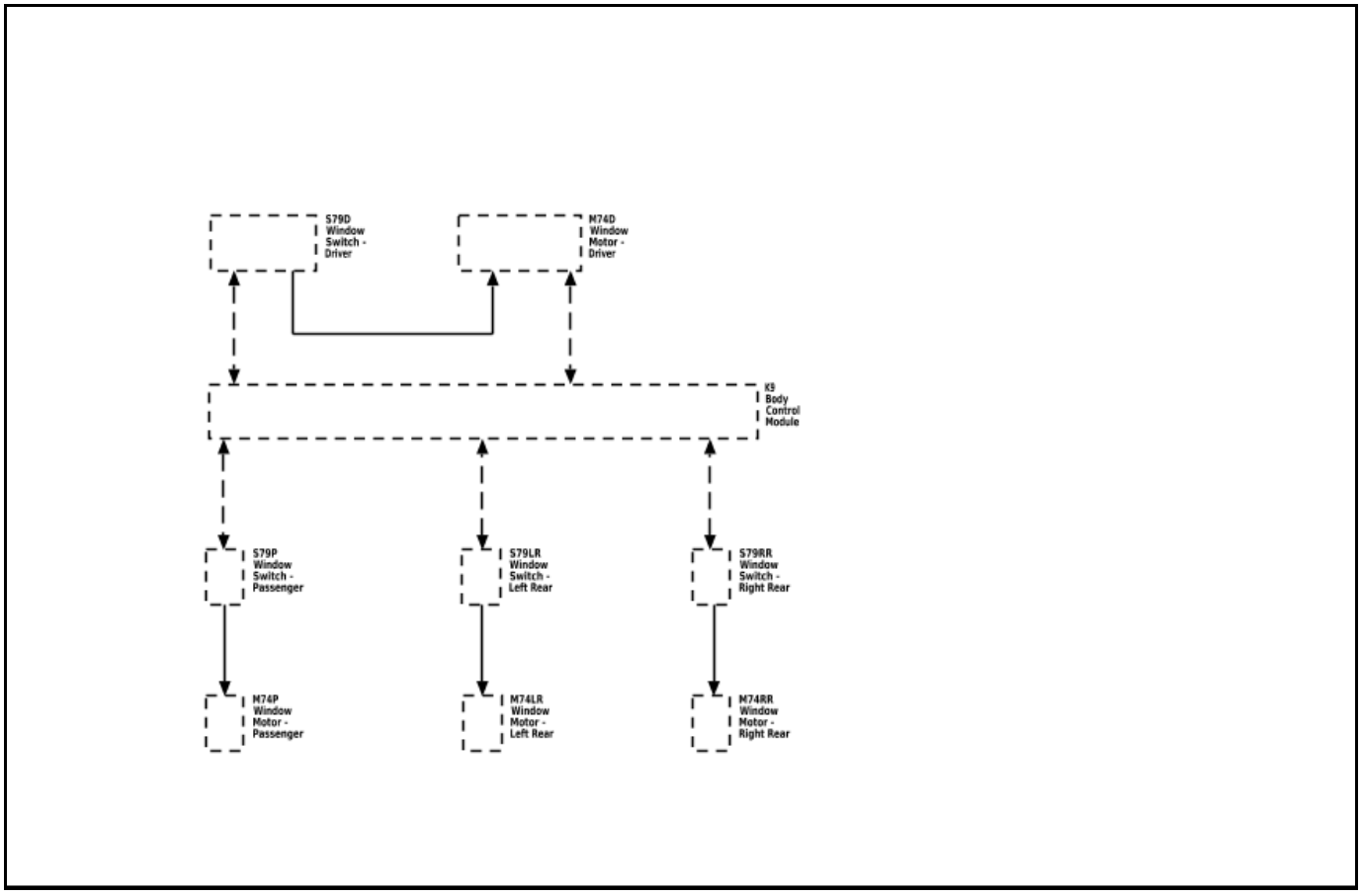
Description and Operation

Power Windows Description and Operation

Power Windows System Components

The power window system consists of the following components:

- Driver window switch
- Passenger window switch
- Left rear window switch
- Right rear window switch
- Window motors in each of the doors
- 30A Fuse
- Body control module (BCM)



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Driver Express Up and Express Down Power Window Motor

The driver door contains a window motor is smart motor that will detect excessive resistance while performing the express up function and automatically reverse direction to prevent injury to any occupants that may become trapped between the closing window and the door frame. The automatic reverse safety feature can be overridden by pulling and holding the window switch.

The logic circuit within the window motor monitors the up, down and express signal circuits which are normally equal to B+ voltage. When a switch is used on the driver window switch, the contacts close causing a voltage drop within the appropriate signal circuit. The driver window motor will detect the voltage drop and will command the window to move in the direction requested.

Passenger, Left Rear and Right Rear Express Down Window Motors

For the passenger, right rear and left rear doors, when their window switch is pressed in the down position, battery positive voltage is applied to their respective window motor control circuit and ground to the other window motor control circuit causing that window to open. When the individual window switch is pulled in the up position, voltage and ground is applied to the window motor in the opposite direction causing that

window to close. The return path to ground is supplied through the inactive control circuit being normally grounded through the window switch.

Each passenger and rear window switch communicates to the BCM by a serial data circuit. When the driver wishes to control the passenger, left rear or right rear window, the driver will use the appropriate switch on the driver window switch. When this switch is used, a serial data message is sent to the BCM requesting a window motor command, the BCM will then send a serial data message to the appropriate door window switch which will then command that window to move in the direction requested.

Lockout Switch Feature

The driver window switch contains a window lockout switch, when the driver presses the window lockout switch, a serial data message is sent to the BCM which will send a disable command to the rear window switches, the rear window switches will then ignore all functions when a passenger uses the rear window switch. The rear window motor commands will still function normally when the driver uses the appropriate switches on the driver window switch.

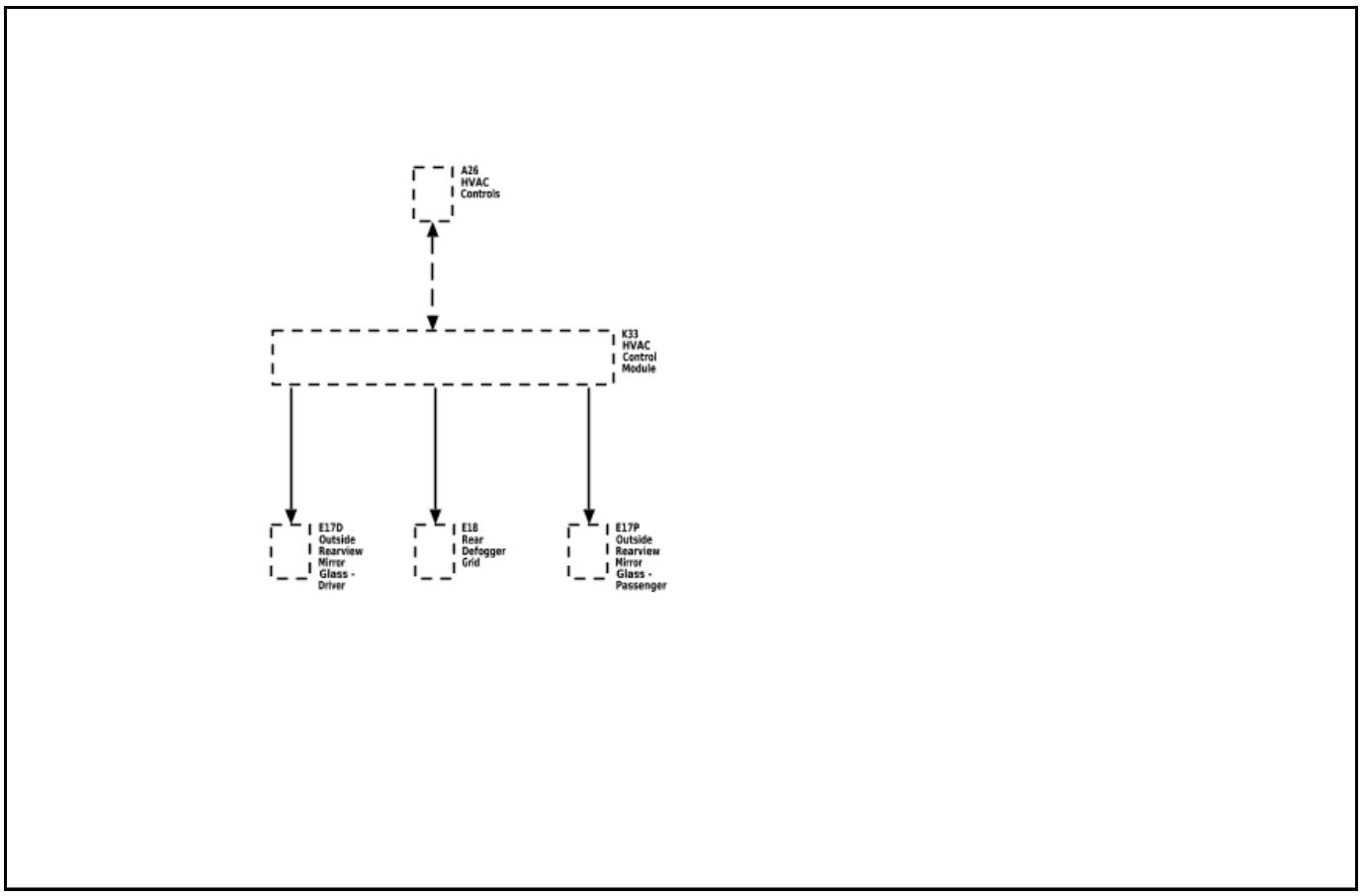
Rear Window Defogger Description and Operation

Rear Window Defogger System Components

The rear window defogger system consists of the following components:

- HVAC Control Module
- HVAC Controls
- Rear Defogger Relay
- Rear Defogger Grid
- Driver Outside Rearview Mirror
- Passenger Outside Rearview Mirror
- 40A Fuse

A26-K33-X50A Defogger Block Diagram



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Rear Window Defogger Operation

The rear defog control system utilizes a single zone backlight design, driven with a single relay configuration. Additionally, up to two outside rear view mirrors can be heated if required. A switch for the customer to control the system is provided within the HVAC controls. Also included in the HVAC controls is an indicator to inform the customer with the current state of the system. The system is only operational when engine is running or during remote start.

Pressing the heated rear window switch causes the HVAC controls to send a serial data message to the HVAC control module requesting rear window defog operation. The HVAC control module upon receipt of the serial data message will provide voltage to the coil side of the rear defogger relay, this will energize the relay causing the relay switch contacts to close allowing B+ voltage to flow through the rear defogger grid control circuit to the rear defogger grid.

When the rear heated rear window switch is pressed and the engine is running, the rear window defogger grid will activate and will turn off automatically depending upon the vehicle speed (refer to owner's manual for rear window defogger operation cycles)

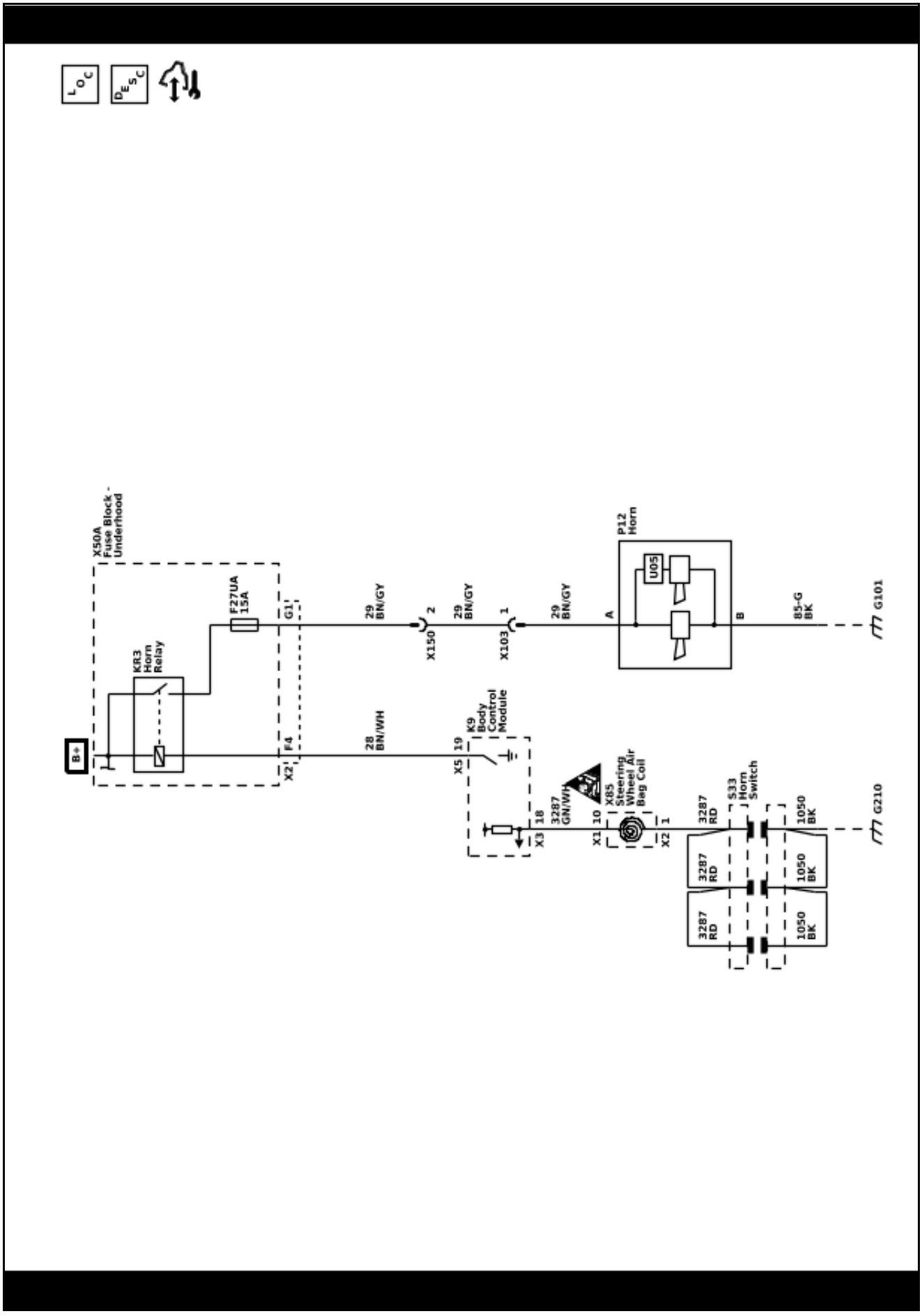
Heated Mirrors

The heated mirrors are also controlled through the rear defogger relay. Whenever the rear window defogger is turned on battery voltage is supplied to the mirror heater elements through the left and right mirror heater element control circuits.

Horns and Pedestrian Alerts

Schematic and Routing Diagrams

Horn Schematics (Horn)



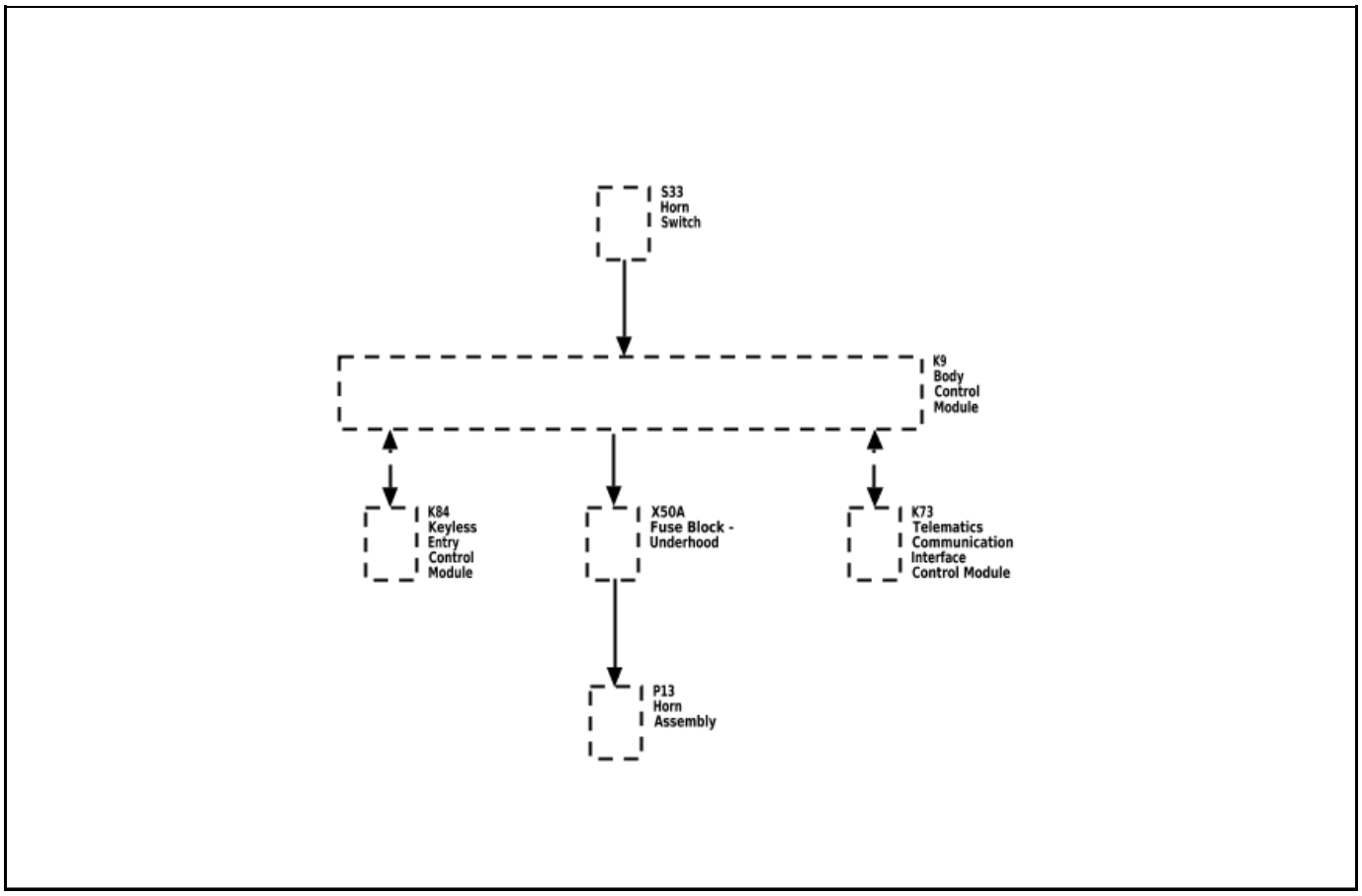
Description and Operation

Horns System Description and Operation

System Description

The horn system consists of the following components:

- HORN fuse
- Underhood fuse block (Contains PCB horn relay)
- Horn switch
- Horn assembly
- Body control module (BCM)



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System Operation

The vehicle horn system is activated under the following conditions:

- When the horn switch is depressed
- The BCM commands the horns ON under any of the following conditions:
  - When the content theft deterrent system detects a vehicle intrusion—For further information refer to Theft Systems Description and Operation.
  - When the panic button is depressed on the remote control door lock transmitter—For further information refer to *Keyless Entry System Description and Operation on page 8-9*.
  - When the keyless entry system is used to lock the vehicle, a horn chirp may sound to notify the driver that the vehicle has been locked. The notification feature may be enabled or disabled through personalization. For further information refer to *Keyless Entry System Description and Operation on page 8-9*.
  - When the OnStar® system is used to sound the horns if equipped—For further information, refer to OnStar Description and Operation.

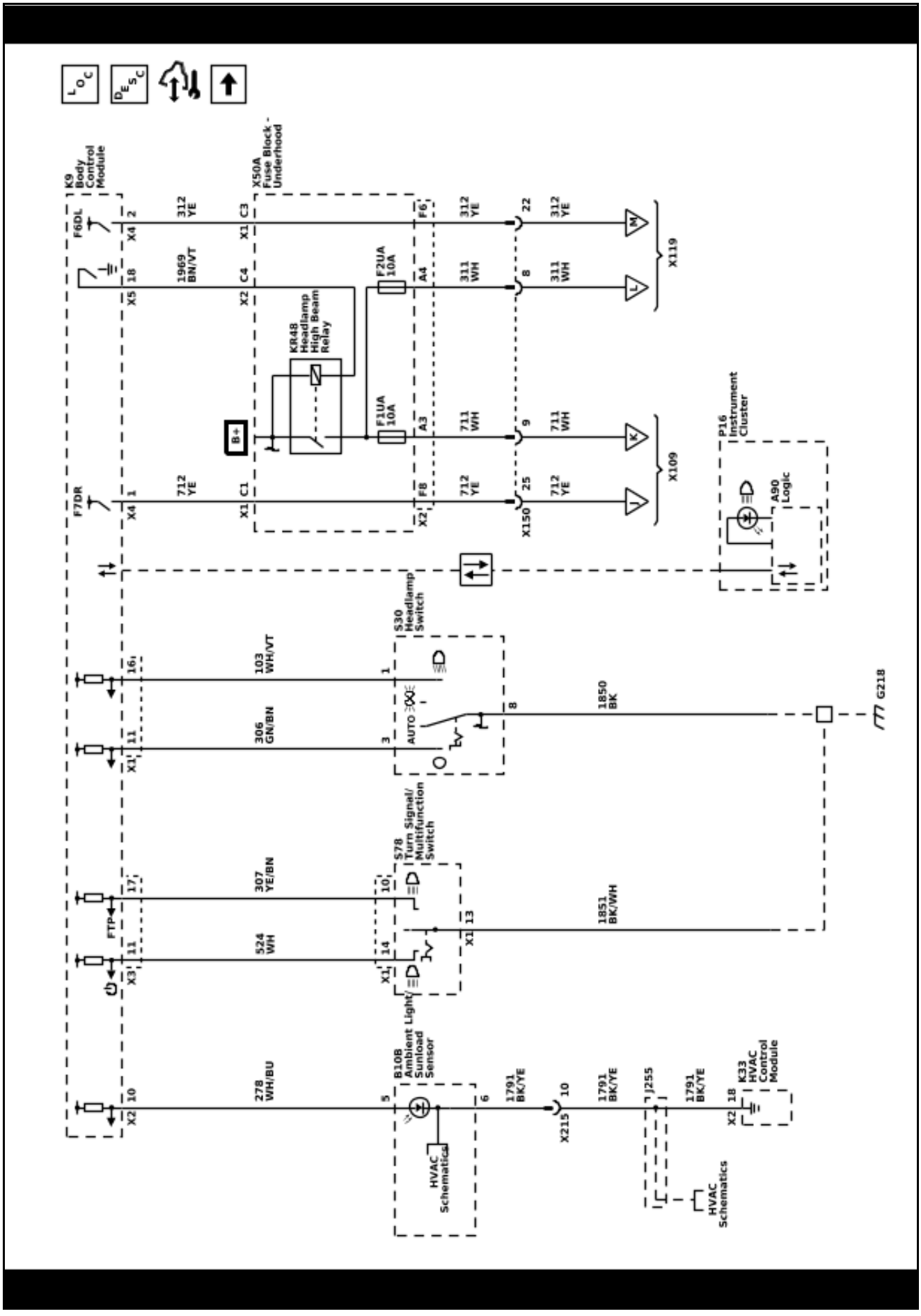
Circuit Operation

Battery positive voltage is applied at all times to the horn relay coil and the horn relay switch. Pressing either of the horn switches applies ground to the horn relay control circuit. The BCM may also apply ground to the horn relay control circuit as described above. When the horn relay control circuit is grounded, the horn relay is energized and battery positive voltage is applied to the horns through the horn control circuit. The horns sound as long as ground is applied to the horn relay control circuit.

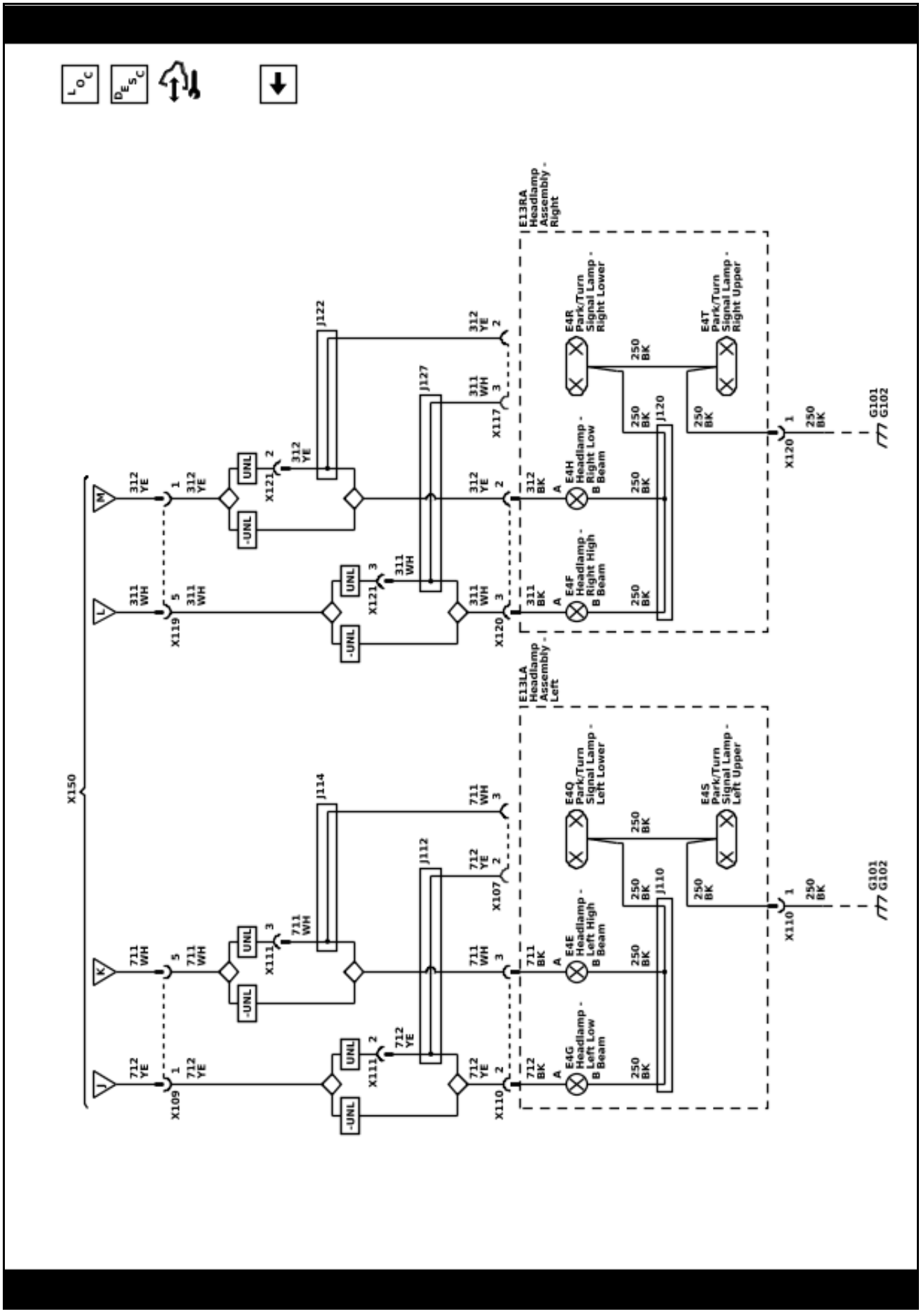
Lighting

Schematic and Routing Diagrams

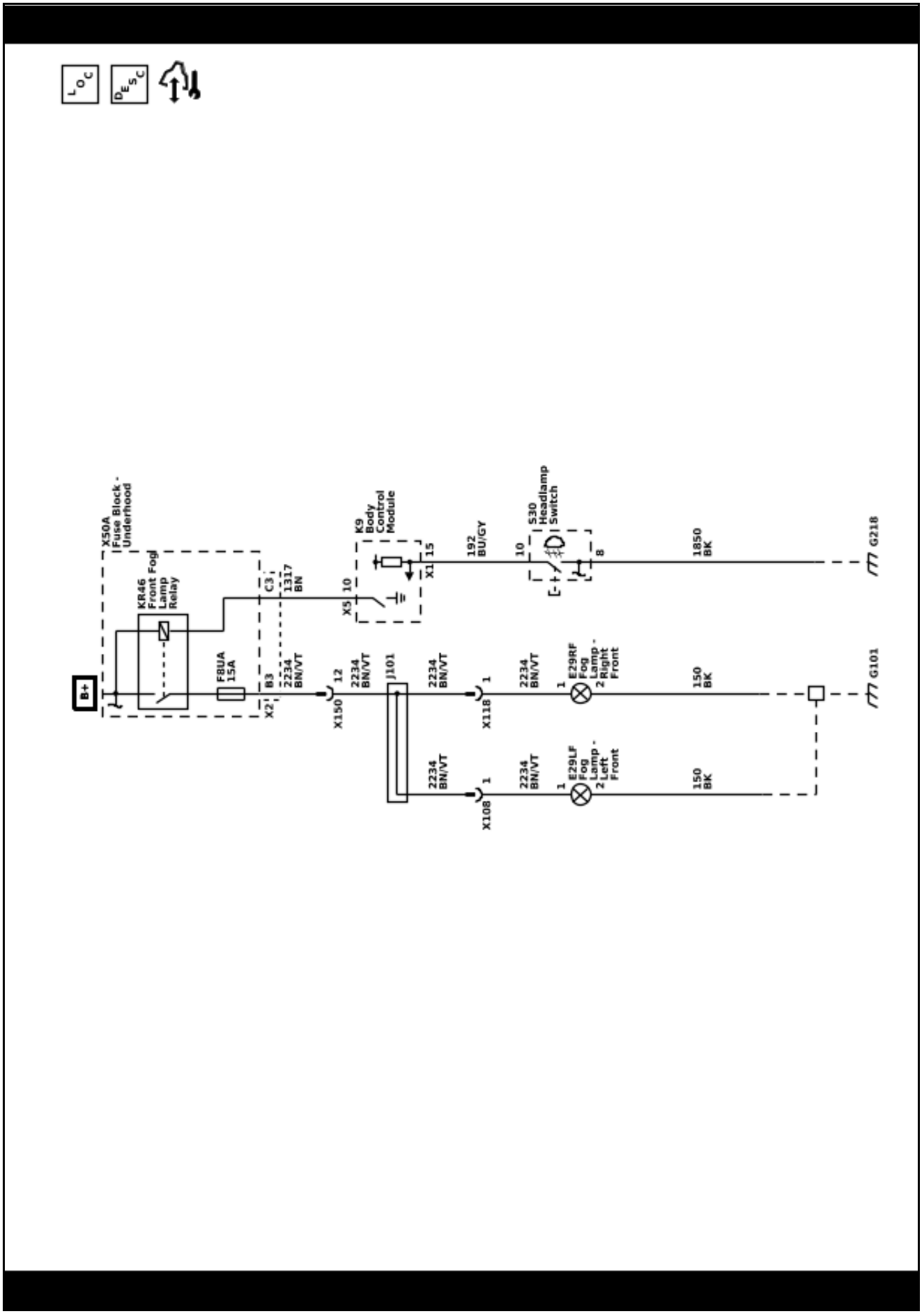
Headlights/Daytime Running Lights (DRL) Schematics (Headlight Controls)



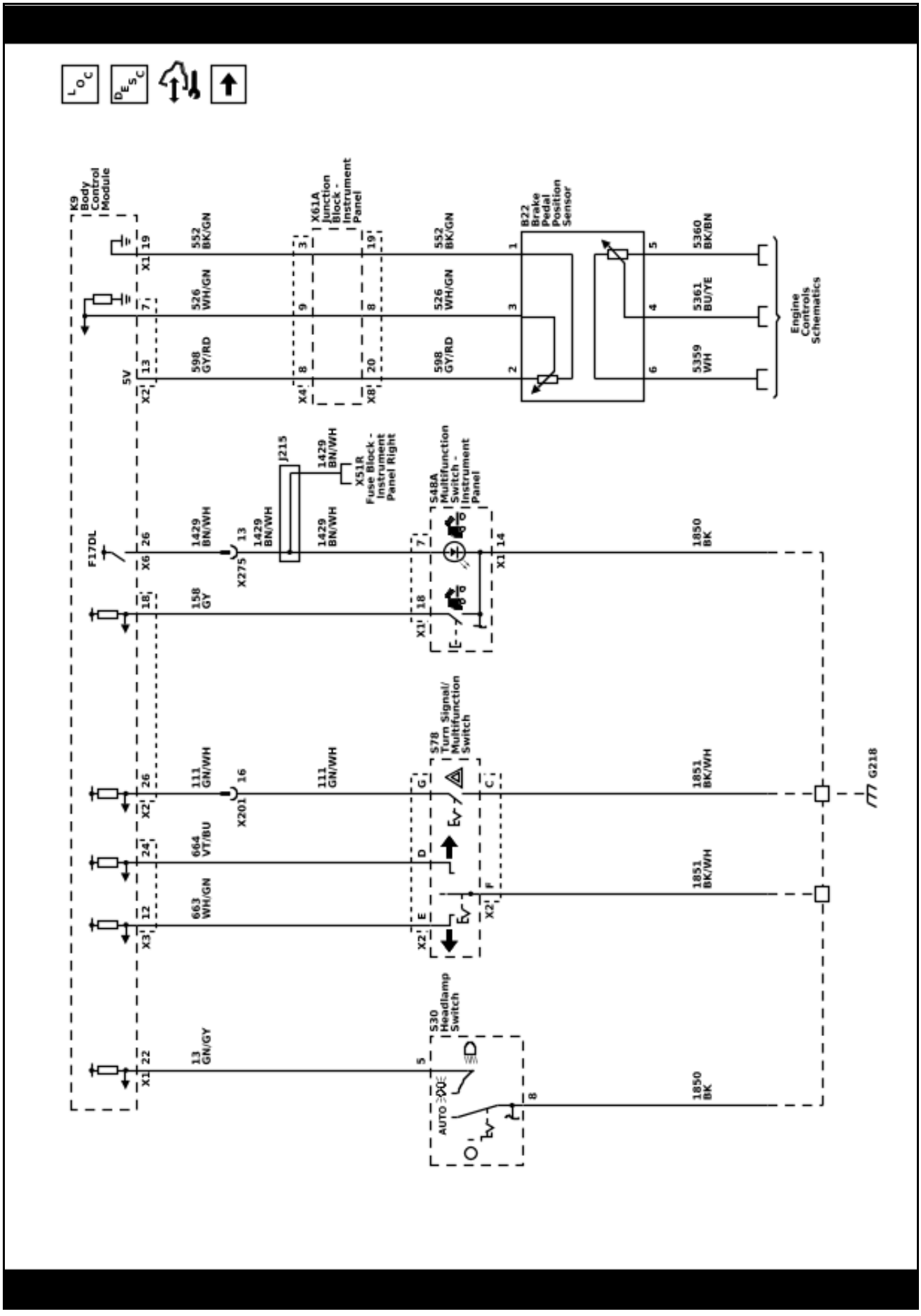
Headlights/Daytime Running Lights (DRL) Schematics (Headlamps)



Fog Lights Schematics (Fog Lamps (T3U))

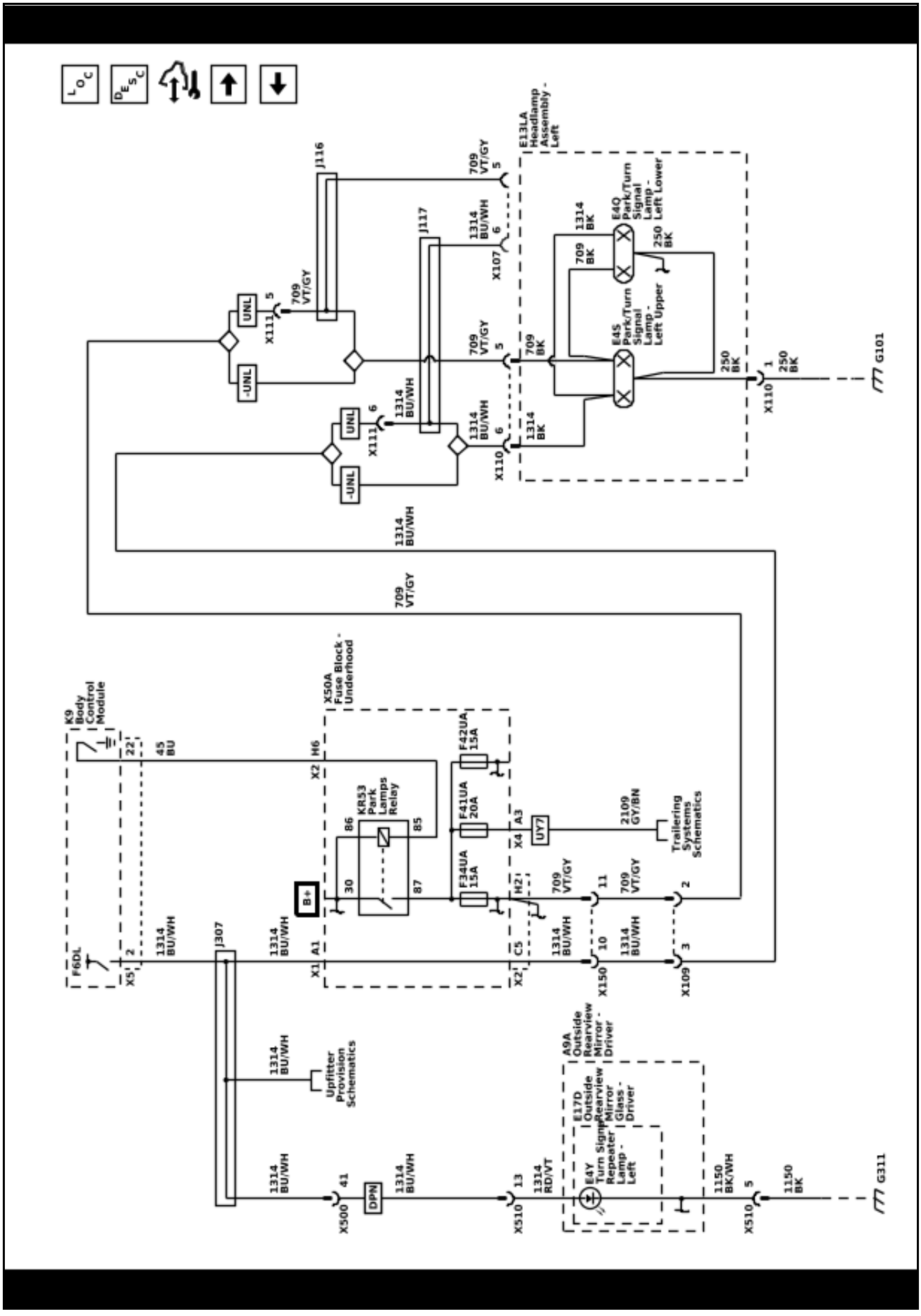


Exterior Lights Schematics (Exterior Lights Controls)

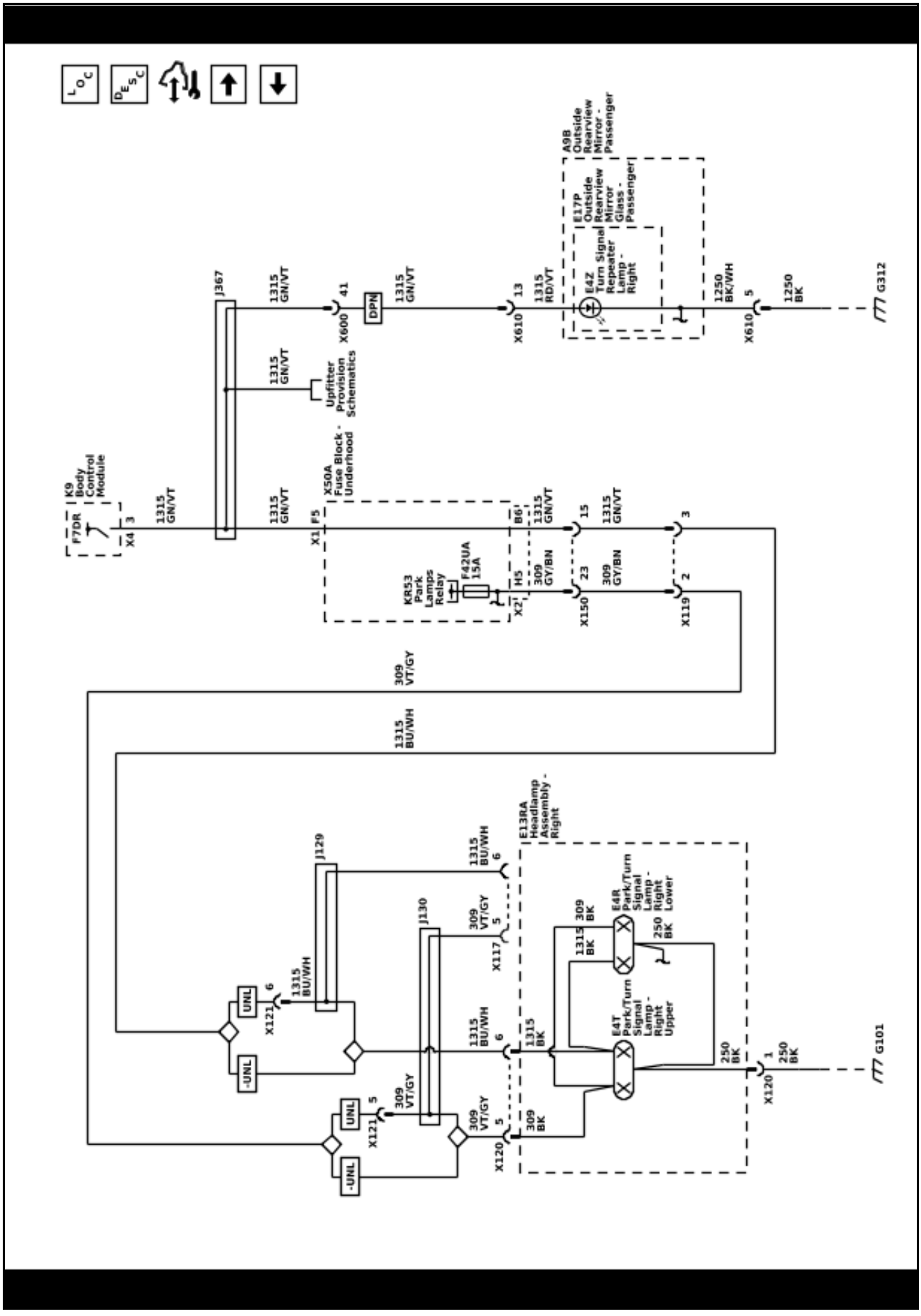


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Exterior Lights Schematics (Park and Turn Signal Lamps - Left Front)

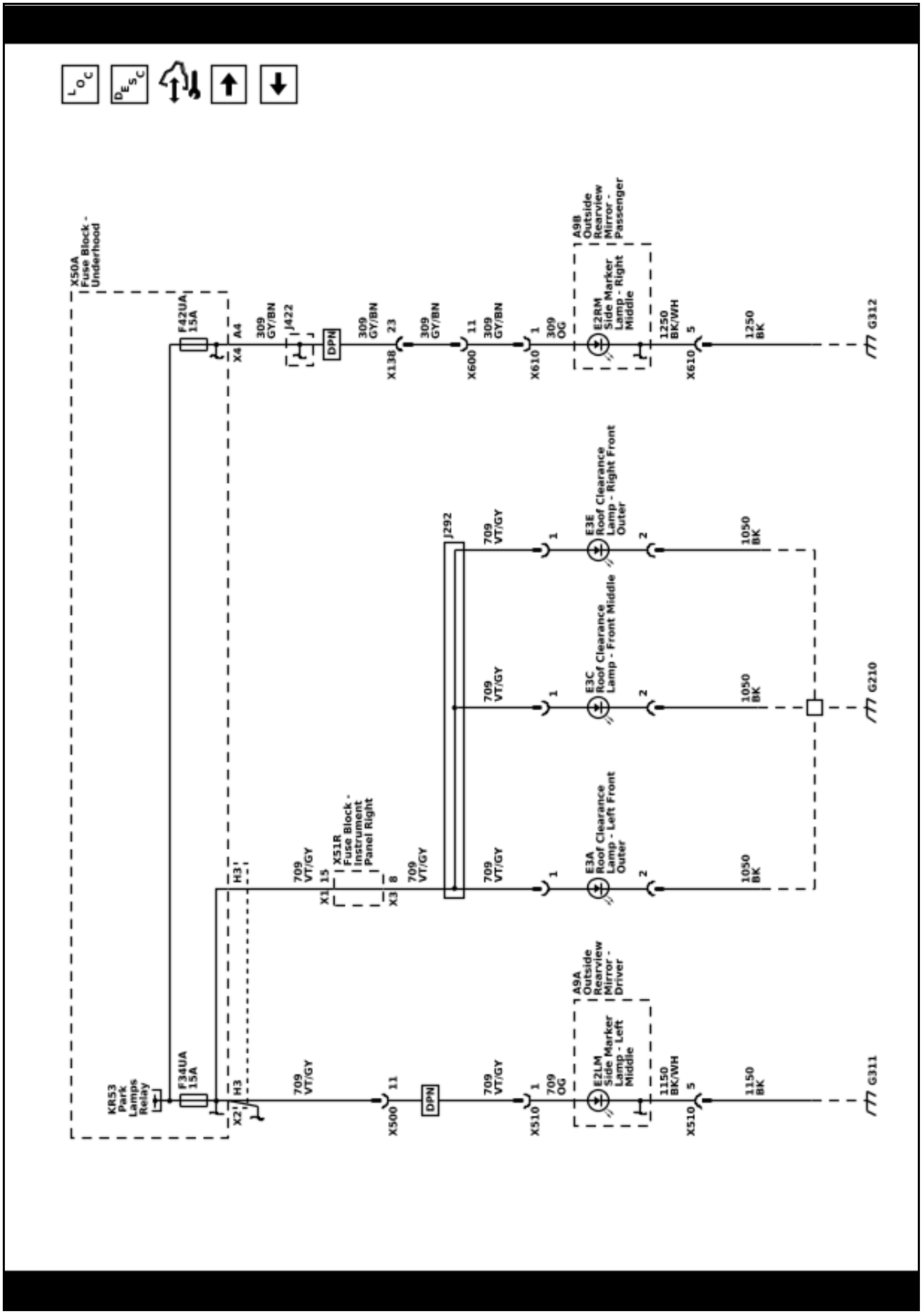


Exterior Lights Schematics (Park and Turn Signal Lamps - Right Front)

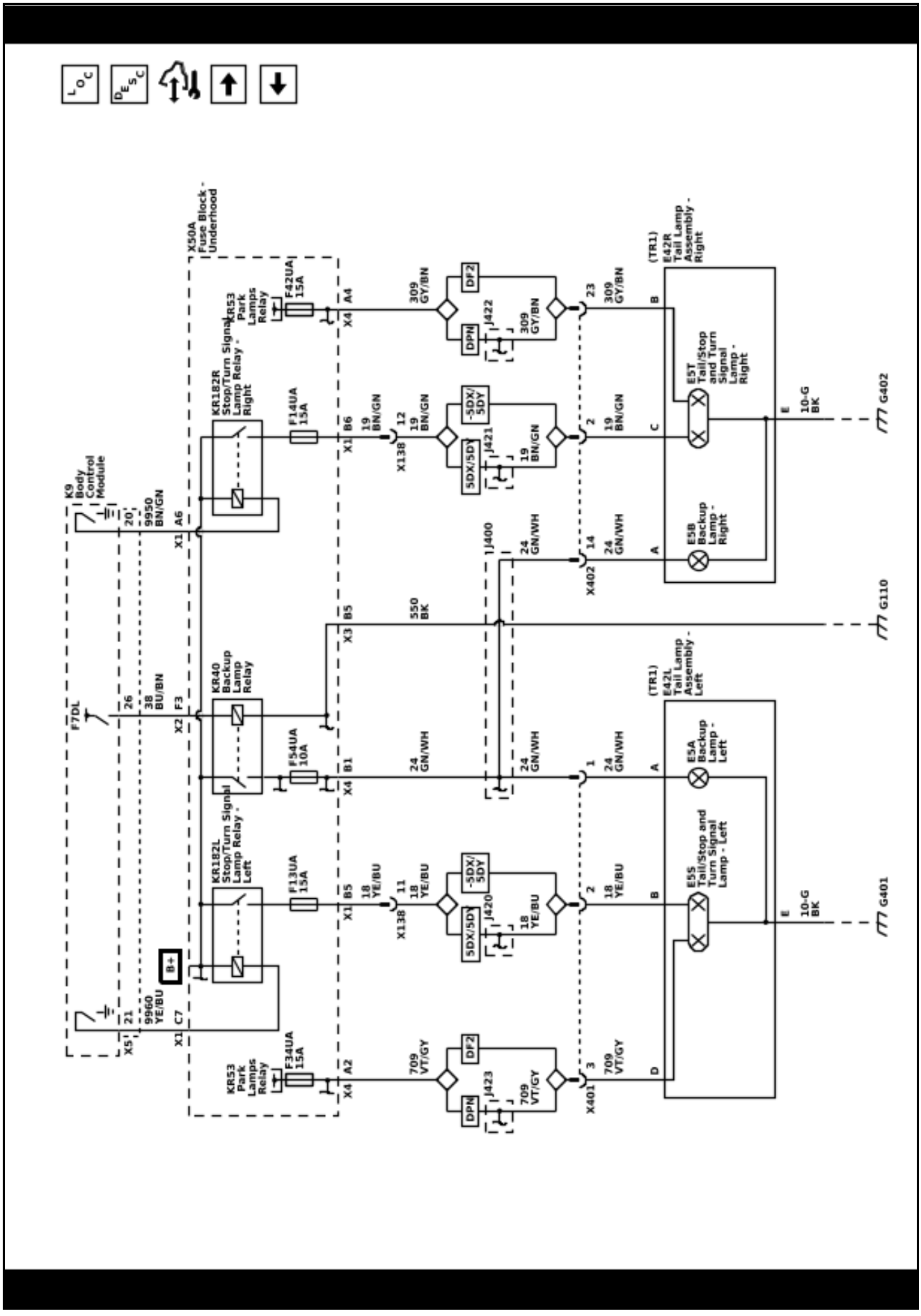


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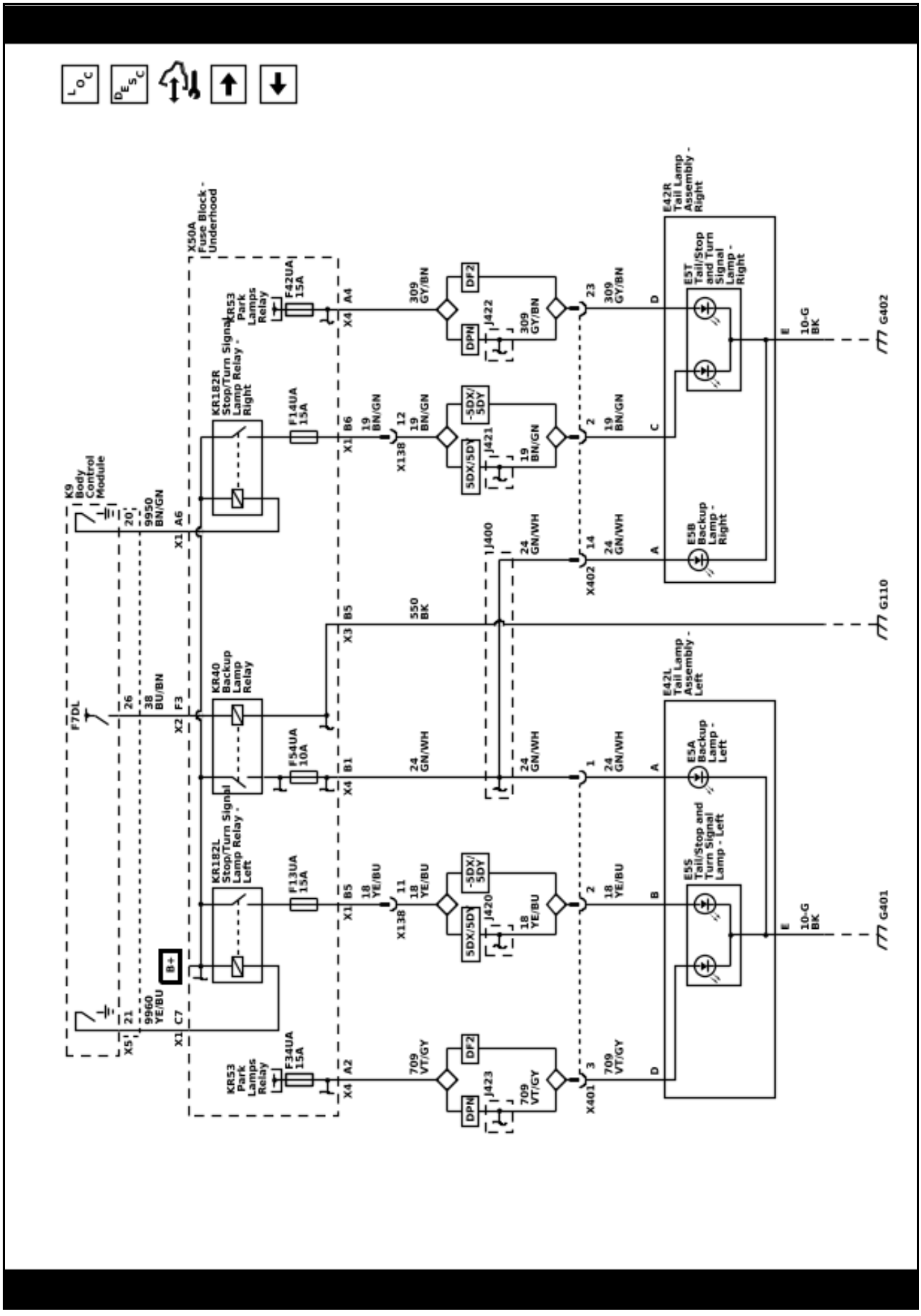
Exterior Lights Schematics (Park Lamps - Mirror (DPN) and Roof)



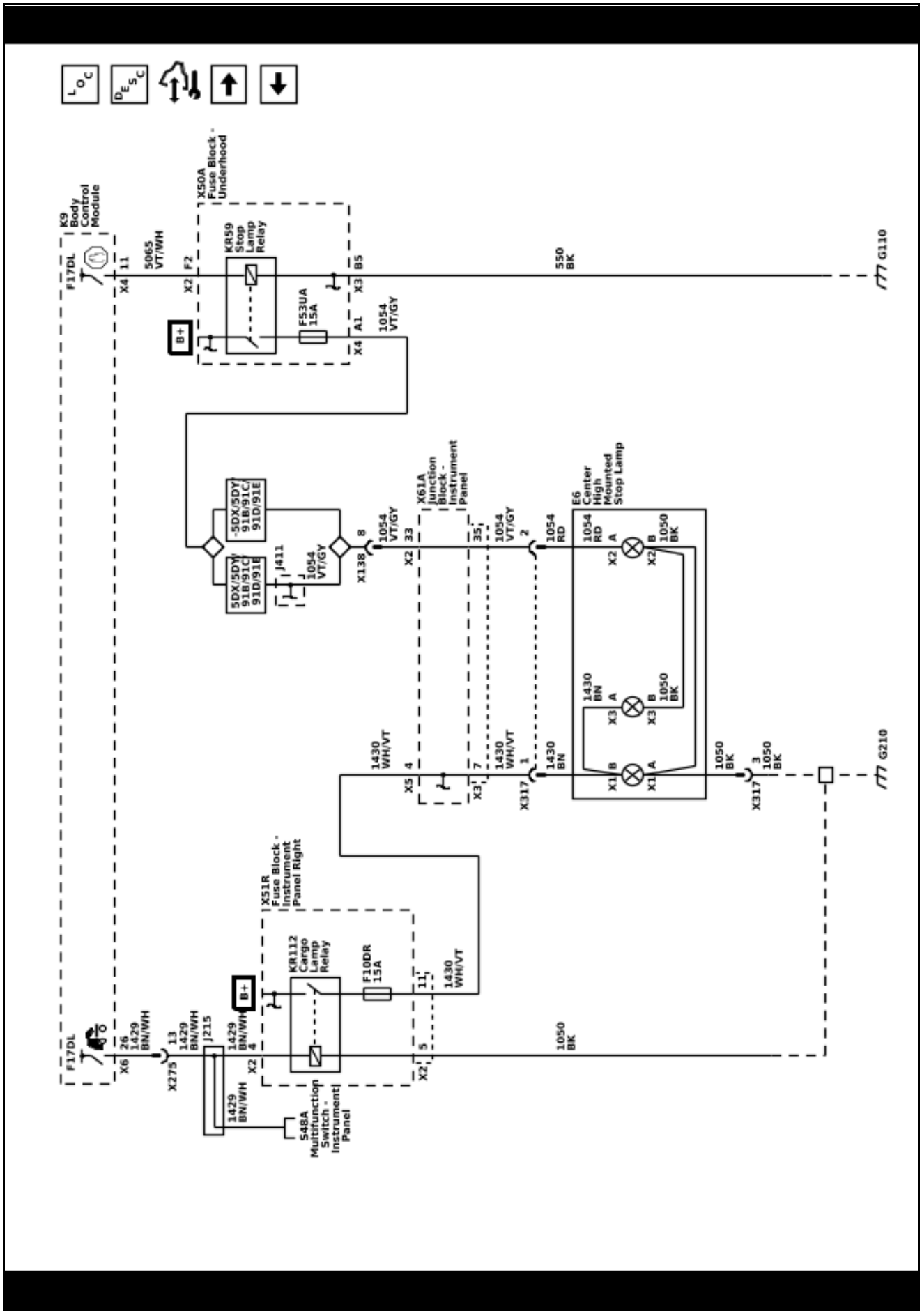
Exterior Lights Schematics (Tail Lamps - Incandescent (TR1/UEA))



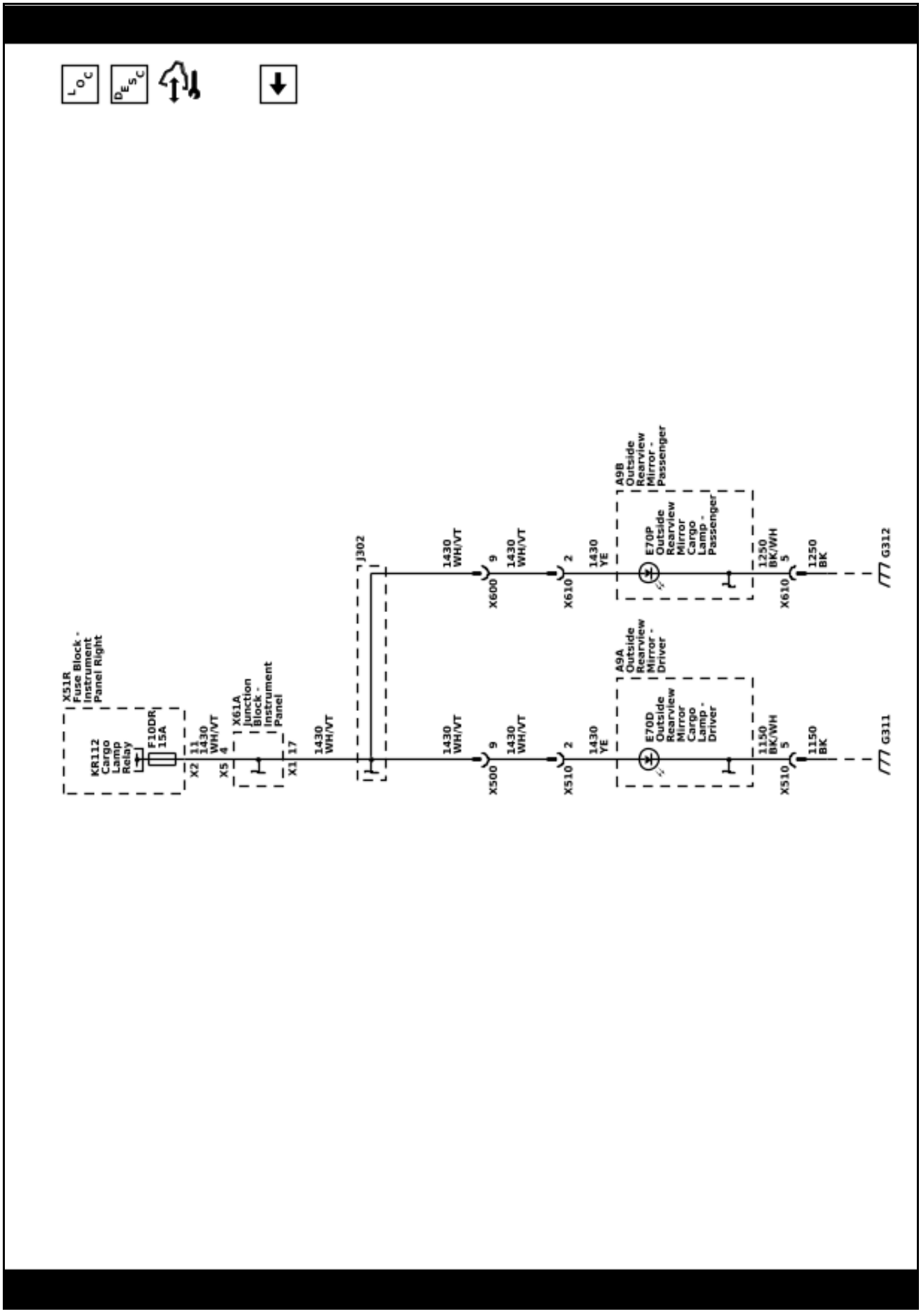
Exterior Lights Schematics (Tail Lamps - LED (UGE))



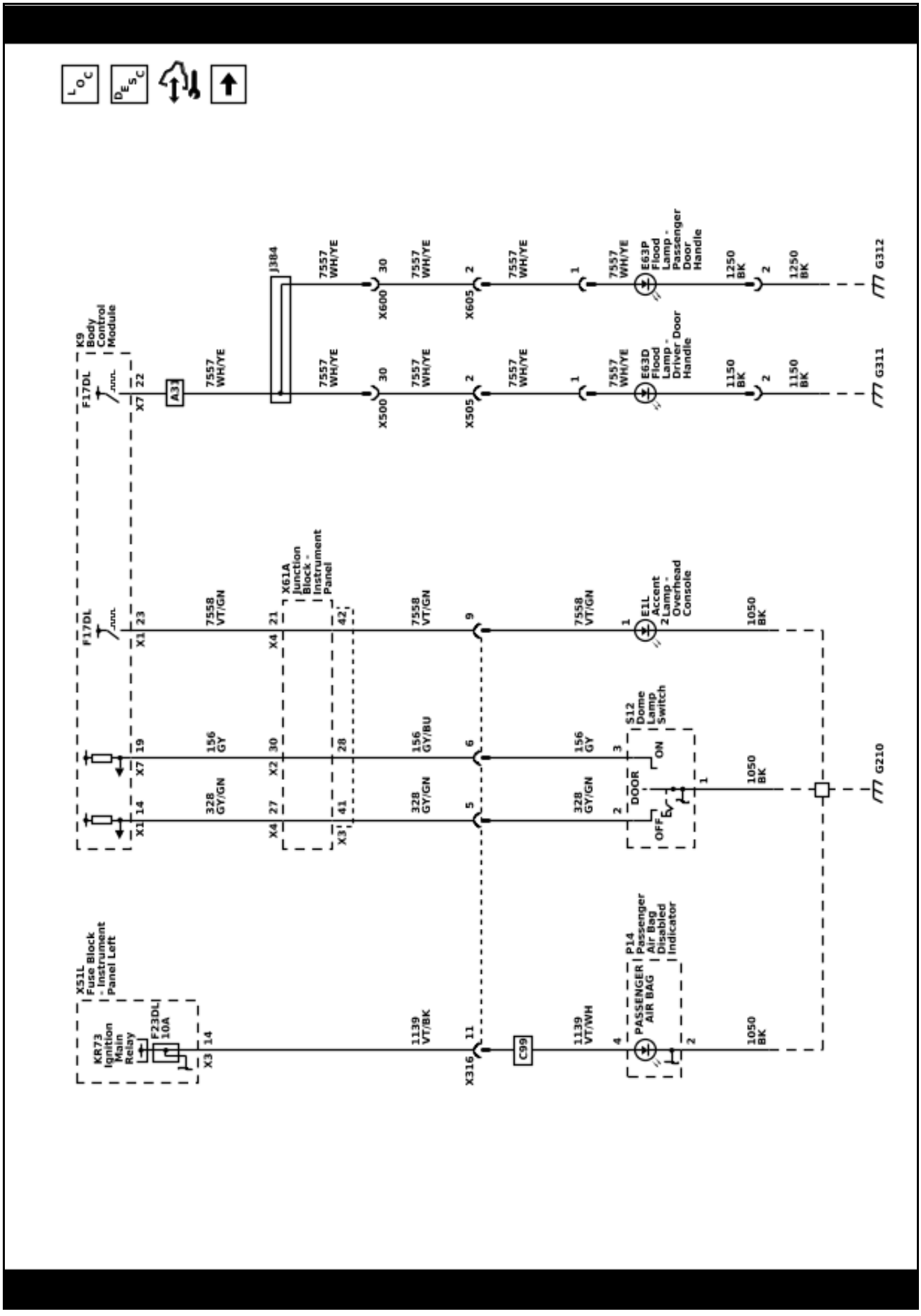
Exterior Lights Schematics (Roof Cargo and Center High Mounted Stop Lamps)



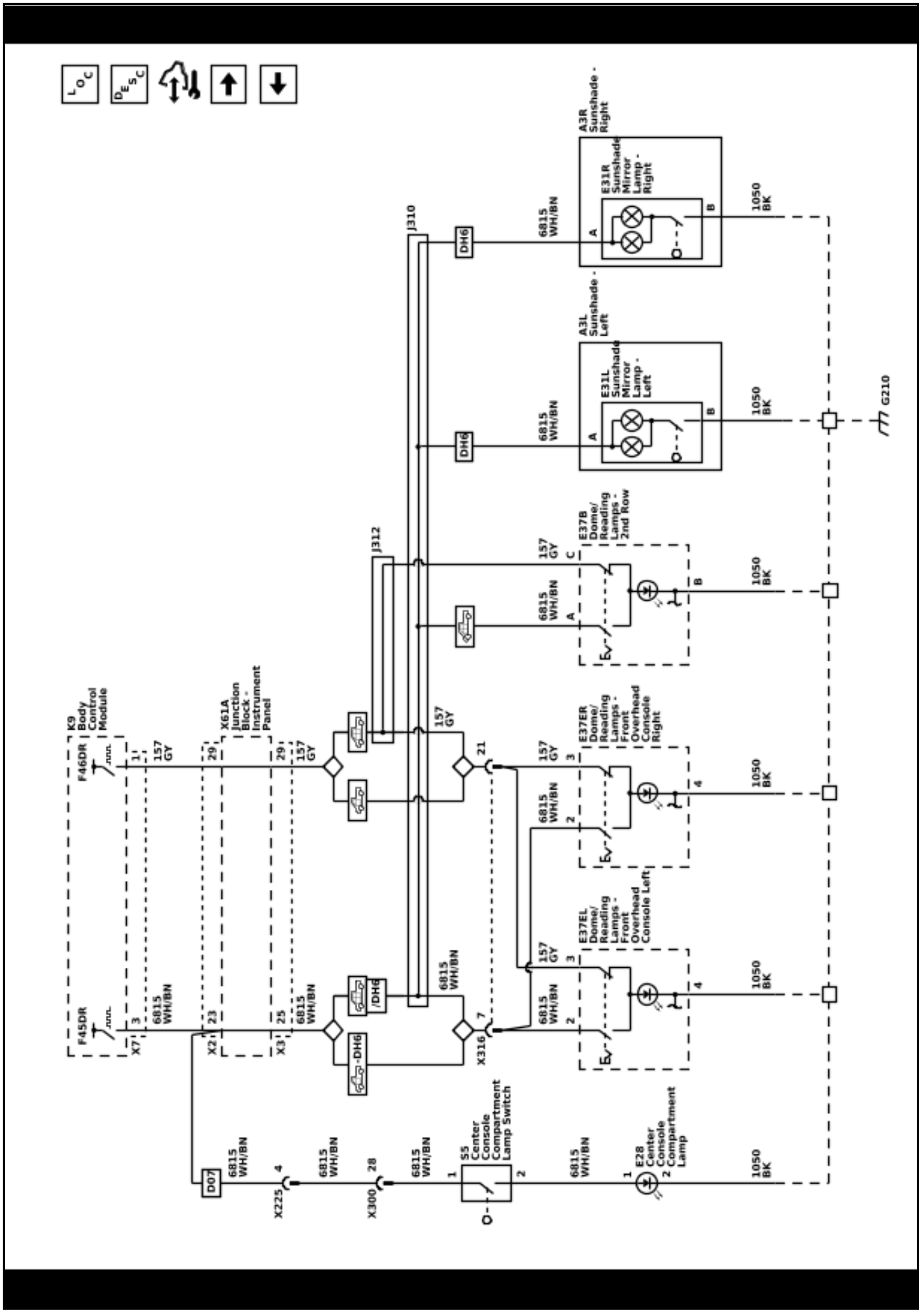
Exterior Lights Schematics (Mirror Cargo Lamps (DPN))



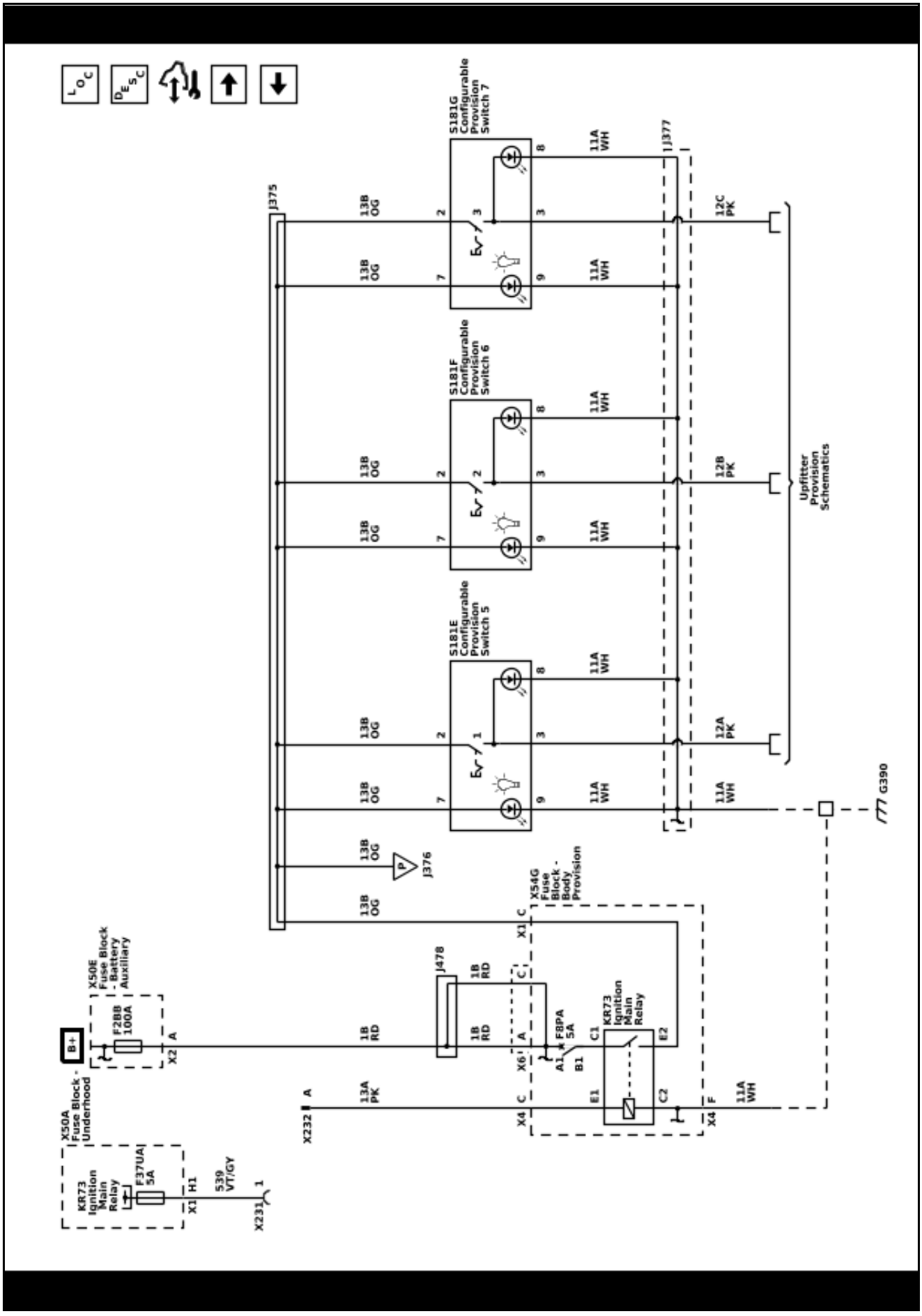
Interior Lights Schematics (Controls and Flood Lamps)



Interior Lights Schematics (Floor Console Compartment and Overhead Lamps)

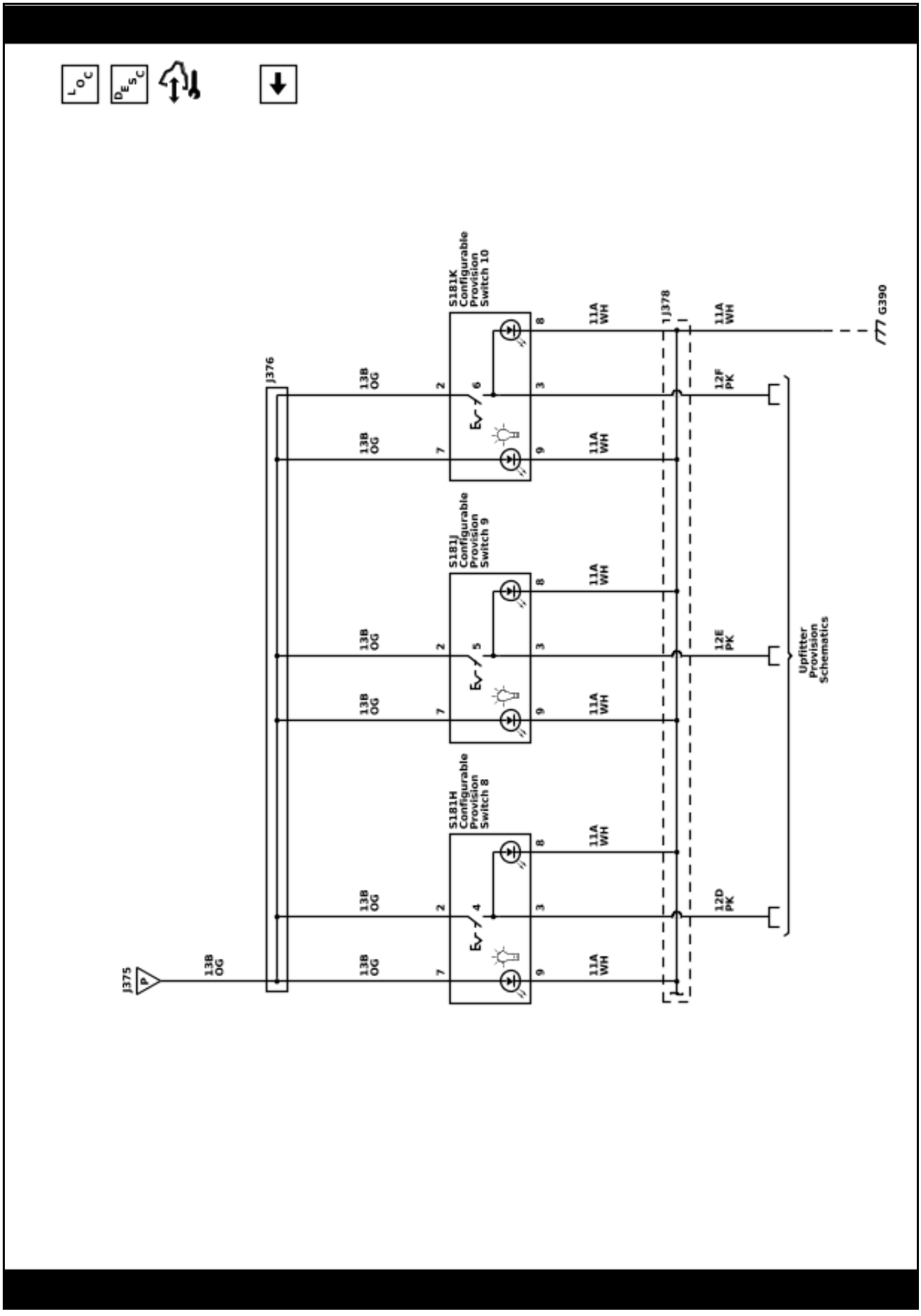


Interior Lights Schematics (Upfitter Switches at Headliner (UEH) (1 of 2))

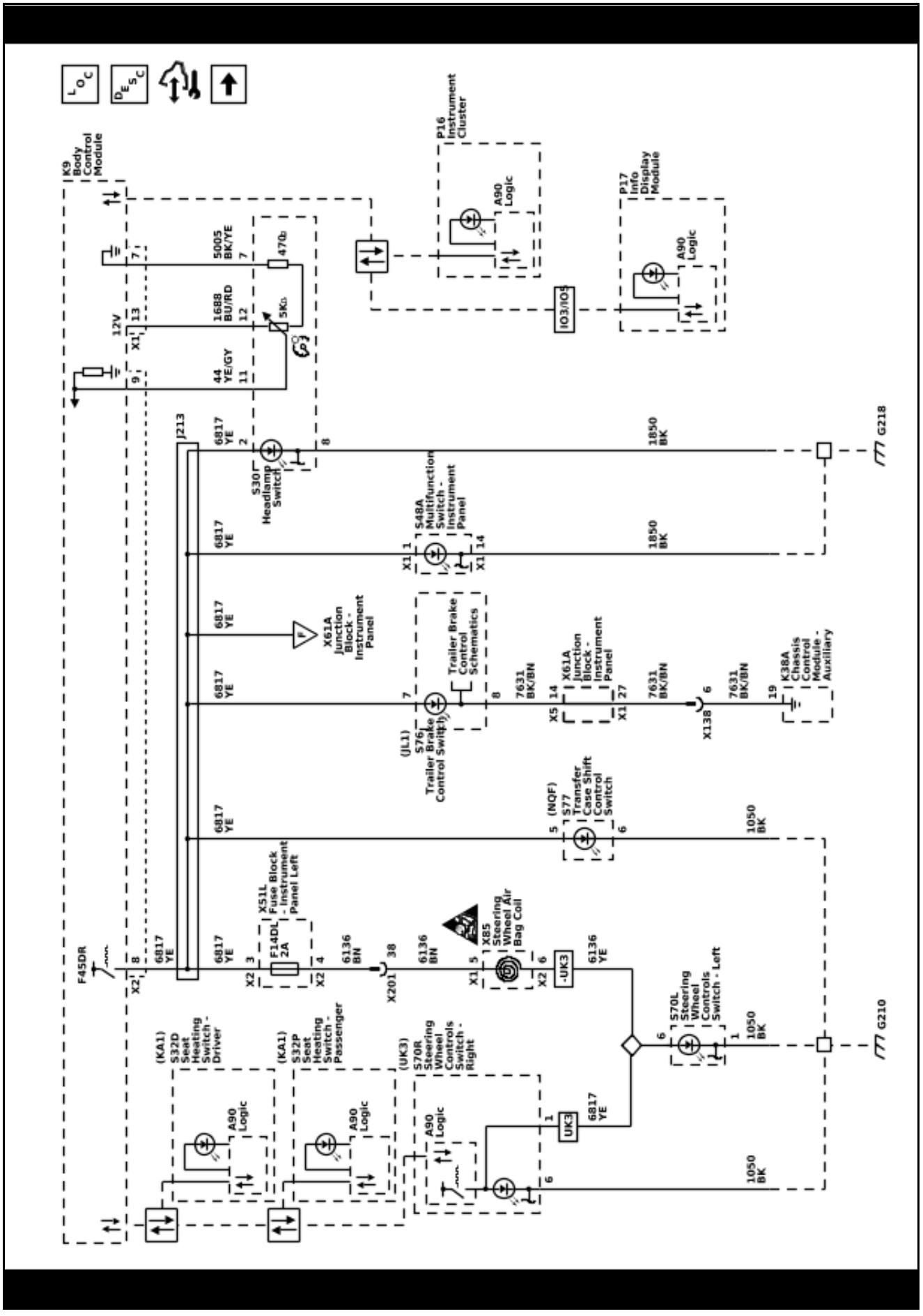


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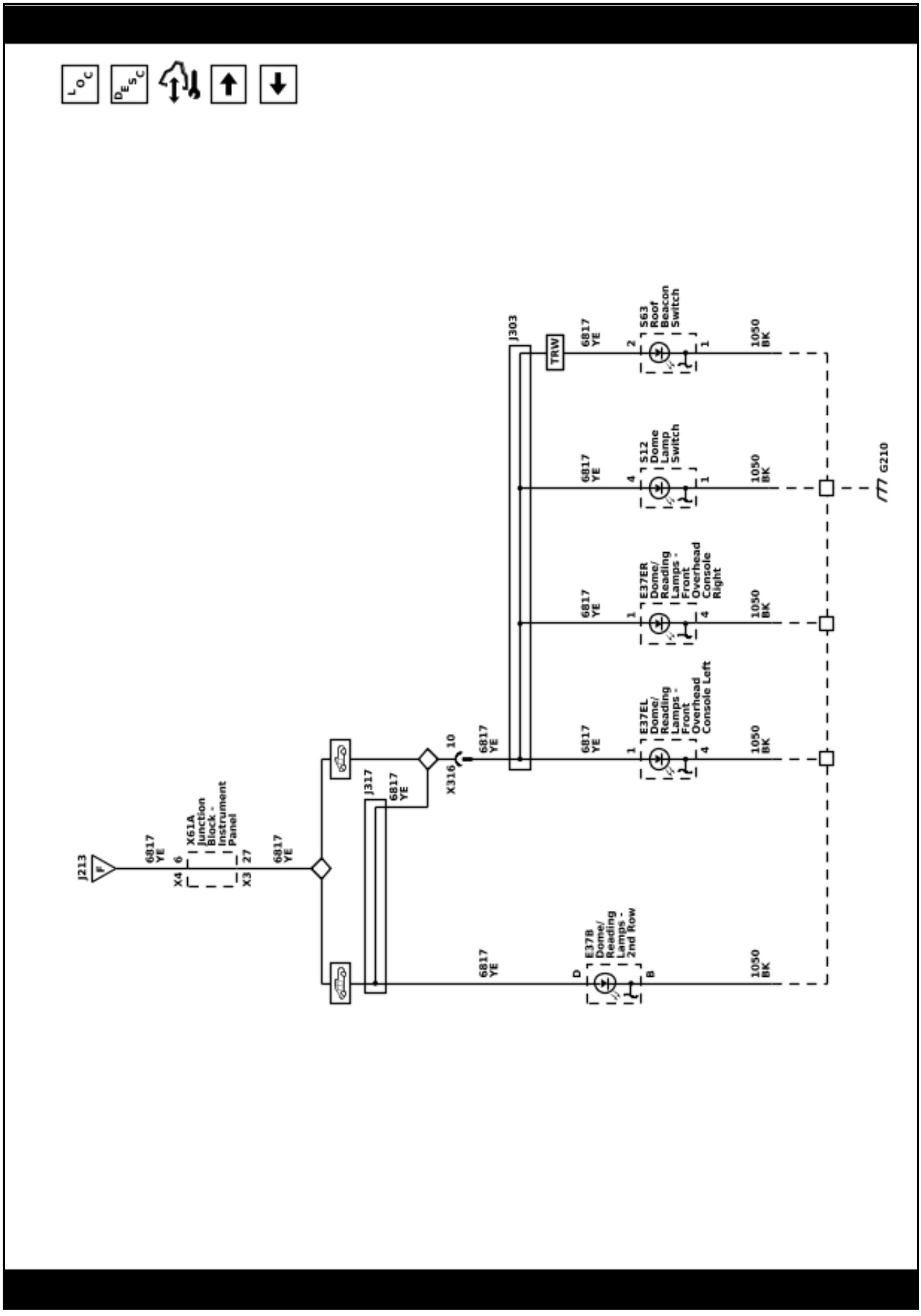
Interior Lights Schematics (Upfitter Switches at Headliner (UEH) (2 of 2))



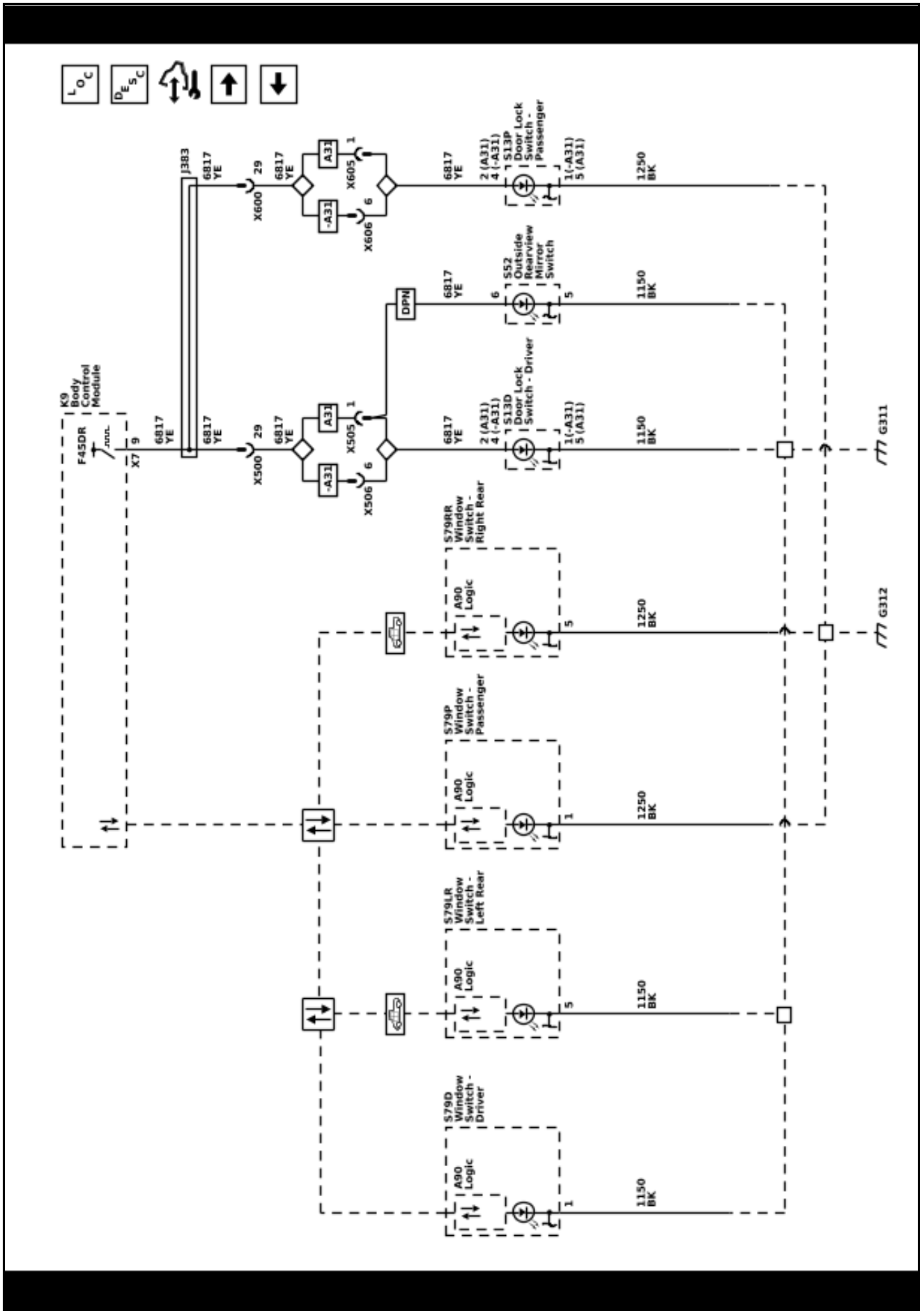
Interior Lights Dimming Schematics (Controls and Backlight - Instrument Panel)



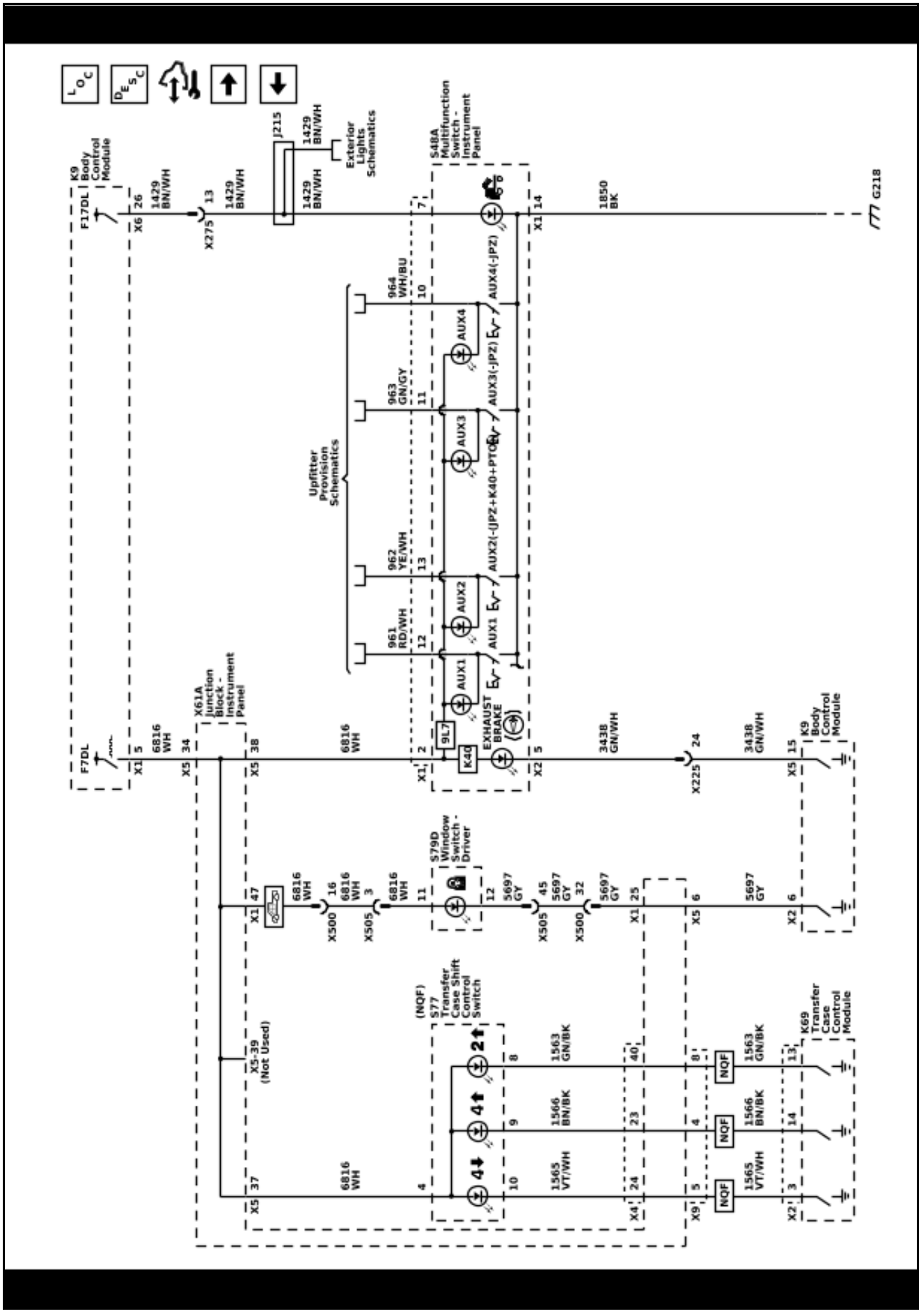
Interior Lights Dimming Schematics (Backlight - Overhead Lamps)



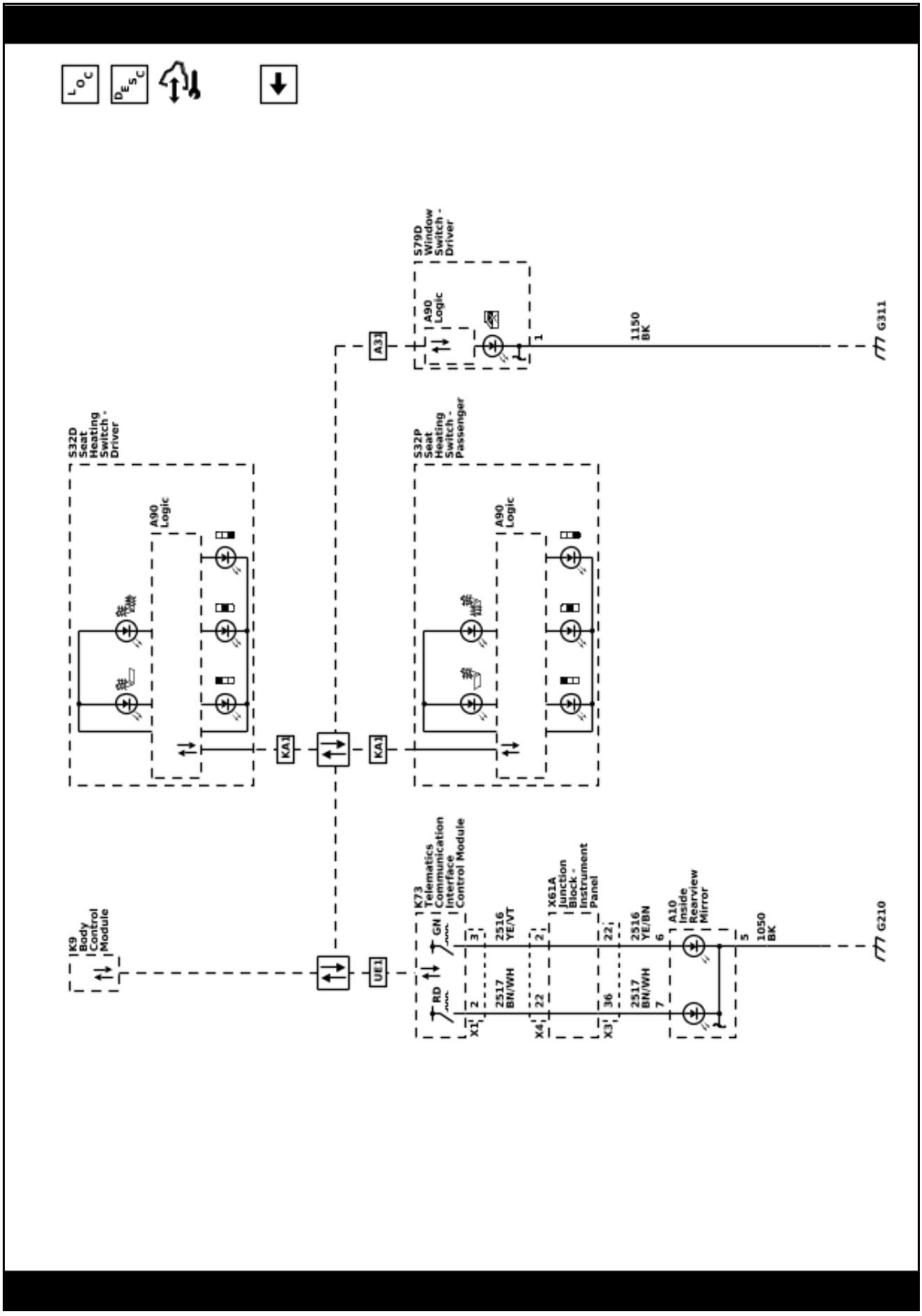
Interior Lights Dimming Schematics (Backlight - Doors)



Interior Lights Dimming Schematics (Indicators - Discrete)



Interior Lights Dimming Schematics (Indicators - Serial Data)



Description and Operation

Exterior Lighting Systems Description and Operation

The exterior lighting system consist of the following lamps:

- Backup lamps
- Front fog lamps
- Hazard warning lamps
- Headlamps
- Park, tail, license, and marker lamps
- Stop lamps
- Turn signal lamps
- Trailer lighting

Low Beam Headlamps

The headlamps may be turned ON in 3 different ways:

- When the headlamp switch is placed in the ON position, for normal operation
- When the headlamp switch is placed in the AUTO position, for automatic lamp control
- When the headlamp switch is placed in the AUTO position, with the windshield wipers ON in daylight conditions, after a 6 second delay

The BCM will also command the low beam headlamps ON during daylight conditions when the following conditions are met:

- Headlamp switch in the AUTO position
- Windshield wipers ON
- Vehicle in any gear but PARK

When the BCM commands the low beam headlamps ON, the vehicle operator will notice the interior backlighting for the instrument cluster and the various switches with backlighting control will dim to the level of brightness selected by the instrument panel dimmer switch.

The body control module (BCM) monitors three signal circuits from the headlamp switch. When the headlamp switch is in the AUTO position, all three signal circuits are open. When placed in the AUTO position, the BCM monitors inputs from the ambient light sensor to determine if headlamps are required or if daytime running lamps will be activated based on outside lighting conditions. When the headlamp switch is placed in the OFF position, the headlamp switch headlamps OFF signal circuit is grounded, indicating to the BCM that the exterior lamps should be turned OFF. With the headlamp switch in the PARK position, the headlamp switch park lamps ON signal circuit is grounded, indicating that the park lamps have been requested. When the headlamp switch is placed in the HEADLAMP position, both the headlamp switch park lamps ON signal circuit and the headlamp switch headlamps ON signal circuit are grounded. The BCM responds to the inputs by illuminating the park lamps and headlamps. When the low beam headlamps are requested, the BCM applies B+ to both low beam headlamp control circuits illuminating the low beam headlamps.

High Beam Headlamps

When the low beam headlamps are ON and the turn signal/multifunction switch is placed in the high beam position, ground is applied to the BCM through the high beam signal circuit. The BCM responds to the high beam request by applying ground to the high beam relay control circuit which energizes the high beam relay. With the high beam relay energized, the switch contacts close allowing battery voltage to flow through the 3 pin high beam fuse to the high beam control circuits illuminating the left and right high beam headlamps.

Flash to Pass

When the turn signal/multifunction switch is momentarily placed in the flash to pass position, ground is applied to the turn signal/multifunction switch. The turn signal/multifunction switch applies ground to the body control module (BCM) through the flash to pass switch signal circuit. The BCM responds to the flash to pass request by applying ground to the high beam relay control circuit. This energizes the high beam relay, closing the switch side contacts of the high beam relay, applying battery voltage to the 3 pin high beam fuse. Battery voltage is applied from the high beam fuse through the high beam control circuit to the high beam headlamp assemblies. This causes the high beam headlamps to illuminate at full brightness momentarily.

Front Fog Lamps

The front fog lamp relay is supplied with battery voltage at all times. The front fog lamp switch signal circuit is grounded momentarily by pressing the front fog lamp switch. The body control module (BCM) energizes the front fog lamp relay by applying ground to the front fog lamp relay control circuit. When the front fog lamp relay is energized, the relay switch contacts close and battery voltage is applied through the front fog lamp fuse to the front fog lamp supply voltage circuit which illuminates the front fog lamps.

Hazard Lamps

The hazard flashers may be activated in any power mode. The hazard switch signal circuit is momentarily grounded when the hazard switch is pressed. The body control module (BCM) responds to the hazard switch signal input by supplying battery voltage to all four turn signal lamps in an ON and OFF duty cycle. When the hazard switch is activated, the BCM sends a serial data message to the instrument panel cluster requesting both turn signal indicators to be cycled ON and OFF.

The instrument panel dimmer switch controls the brightness of the interior backlighting components. When the instrument panel dimmer switch is placed in a desired brightness position, the body control module (BCM) receives a signal from the instrument panel dimmer switch and responds by applying a pulse width modulated voltage to the hazard switch light emitting diode (LED) backlighting control circuit illuminating the LED to the desired level of brightness.

Park, Tail, and License Lamps

When the headlamp switch is placed in the HEAD or PARK position, ground is applied to the park lamp switch ON signal circuit to the body control module (BCM). The BCM responds by applying voltage to the park lamps, tail lamps, and license lamps control circuits illuminating the park, tail, and license lamps.

Stop Lamps

The brake pedal position sensor is used to sense the action of the driver application of the brake pedal. The brake pedal position sensor provides an analog voltage signal that will increase as the brake pedal is applied. The body control module (BCM) provides a low reference signal and a 5 V reference voltage to the brake pedal position sensor. When the variable signal reaches a voltage threshold indicating the brakes have been applied, the BCM will apply battery voltage to the left and right stop lamp control circuits as well as the center high mounted stop lamp control circuit illuminating the left and right stop lamps and the center high mounted stop lamp.

Turn Signal Lamps

Ground is applied at all times to the turn signal/ multifunction switch. The turn signal lamps may only be activated with the ignition switch in the ON or START positions. When the turn signal/multifunction switch is placed in either the TURN RIGHT or TURN LEFT position, ground is applied to the body control module (BCM) through either the right turn or left turn signal switch signal circuit. The BCM responds to the turn signal switch input by applying a pulsating voltage to the front and rear turn signal lamps through there respective control circuits. When a turn signal request is received by the BCM, a serial data message is sent to the instrument cluster requesting the respective turn signal indicator be pulsed ON and OFF.

Backup Lamps

Automatic Transmission

With the engine ON and the transmission in the REVERSE position, the transmission control module (TCM) sends a serial data message to the body control module (BCM). The message indicates that the gear selector is in the REVERSE position. The BCM applies battery voltage to the backup lamps control circuit illuminating the backup lamps. Once the driver moves the gear selector out of the REVERSE position, a message is sent by the TCM via serial data requesting the BCM to remove battery voltage from the backup lamps control circuit. The engine must be ON for the backup lamps to operate.

Trailer Lighting

Backup Lamps

For backup lamp operation, the backup lamp relay is supplied with battery voltage at all times. With the engine running and the transmission in the reverse position, the transmission control module (TCM) sends a serial data message to the body control module (BCM). The message indicates that the gear selector is in the reverse position. The BCM energizes the backup lamp relay by applying battery voltage to the backup lamp relay control circuit. When the backup lamp relay is energized, the relay switch contacts close and battery voltage is applied through the backup lamp fuses to the backup lamp control circuits which illuminates the backup lamps. Once the driver moves the gear selector out of the reverse position, a message is sent by the TCM via serial data requesting the BCM to remove battery voltage from the backup lamp relay control circuit.

Park Lamps

When the headlamp switch is placed in the HEAD or PARK position, ground is applied to the park lamp switch ON signal circuit to the body control module (BCM). The BCM responds by applying voltage to the park lamps, tail lamps, license lamps, and trailer park lamps control circuits illuminating the park, tail, license, and trailer park lamps.

Stop Lamps

For stop lamp operation, the left and right trailer stop/ turn signal lamp relay's are supplied with battery voltage at all times. The brake pedal position sensor is used to sense the action of the driver application of the brake pedal. The brake pedal position sensor provides an analog voltage signal that will increase as the brake pedal is applied. The body control module (BCM) provides a low reference signal and a 5 V reference voltage to the brake pedal position sensor. When the variable signal reaches a voltage threshold indicating the brakes have been applied, the BCM energizes the left and right trailer stop/turn signal lamp relay's by applying voltage to the left and right stop lamp relay control circuits. With the left and right trailer stop/turn signal lamp relay's energized, the relay switch contacts close and battery voltage is applied through the left and right trailer stop/turn signal fuse's to the trailer stop lamp control circuits which illuminates the trailer stop lamps.

Turn Signal Lamps

For turn signal lamp operation, the left and right trailer stop/turn signal lamp relay's are supplied with battery voltage at all times. Ground is applied at all times to the turn signal/multifunction switch. The turn signal lamps may only be activated with the ignition switch in the ON or START positions. When the turn signal/multifunction switch is placed in either the TURN RIGHT or TURN LEFT position, ground is applied to the body control module (BCM) through either the right turn or left turn signal switch signal circuit. The BCM responds to the turn signal switch input by applying a pulsating voltage to the left and right trailer stop/turn signal lamp relay control circuits energizing the relay's in an ON and OFF cycle. With the left and right trailer stop/turn signal lamp relay's energized, the relay switch contacts cycle ON and OFF applying battery voltage through the left and right trailer stop/turn signal fuse's to the trailer turn signal lamp control circuits which illuminates the trailer turn signal lamps in an ON and OFF cycle.

Battery Run Down Protection/ Inadvertent Power

To provide battery run down protection, the exterior lamps will be deactivated automatically under certain conditions. The BCM monitors the state of the headlamp switch. If the park or headlamp switch is ON

when the ignition switch is placed in either the CRANK or RUN position and then placed in the OFF position, the BCM initiates a 10 minute timer. At the end of the 10 minutes, the BCM will turn off the control power output to the park lamp controls as well as the headlamp relay coils, deactivating the exterior lamps. This feature will be cancelled if any power mode other than OFF becomes active. The BCM will disable battery run down protection if any of the following conditions exist. The park or headlamp switch is placed in the ON to OFF position, and back to the ON position during battery run down protection. The BCM determined that the park or headlamp switch was not active when the ignition was turned OFF.

Interior Lighting Systems Description and Operation

Interior Lamps

The interior lighting system consist of two groups. This first group includes lamps that may not be dimmed.

- Dome lamps
- Center console compartment lamps
- Reading lamps
- Sunshade mirror lamps

Dome Lamps

The dome lamp switch has 3 positions: DOOR, OFF, and ON. The ON position provides a ground for continuous operation and the dome lamp will remain illuminated until the switch is placed in either the DOOR or OFF position. When in the DOOR position, the dome lamp operation is controlled by the body control module (BCM). When any door is opened, the door ajar switch contacts close and the BCM receives a door-open input. The BCM illuminates the dome lamp when any door is opened or a door lock/unlock request is activated with the key fob. After all doors have been closed, the dome lamp will remain illuminated approximately 3 seconds after the last door closes. When the driver places the dome lamp switch in the OFF position, the dome lamp will be disabled. In the event that the dome lamp were to remain illuminated for more than 10 minutes with the ignition switch in the OFF position and no doors opened, the BCM will deactivate the dome lamp control circuit to prevent total battery discharge. The dome lamps will turn OFF using the theater dimming feature when controlled by the BCM.

Center Console Compartment Lamp

The inadvertent power supply voltage circuit from the BCM provides battery voltage to the center console compartment lamp. When the center console is opened, the center console compartment lamp switch contacts close providing a path to ground and the center console compartment lamp illuminates. If the operator inadvertently leaves the center console compartment door open with the center console compartment lamp ON, the BCM will turn all interior lamps OFF after 10 minutes has passed since any switch activation has been detected by the BCM.

Reading Lamps

The inadvertent power supply voltage circuit from the BCM provides battery positive voltage to each reading lamp. When a reading lamp switch is activated, the switch contacts close providing a path to ground and the reading lamp illuminates. If the operator inadvertently leaves a reading lamp ON, the BCM will turn all interior lamps OFF after 10 minutes has passed since any switch activation has been detected by the BCM.

Sunshade Mirror Lamps

The inadvertent power supply voltage circuit from the BCM provides battery voltage to each set of sunshade mirror lamps. When the sunshade mirror cover is opened, a switch closes providing ground and the sunshade lamps illuminate. If the operator inadvertently leaves a sunshade mirror cover open with the lamps ON, the BCM will turn all interior lamps OFF after 10 minutes has passed since any switch activation has been detected by the BCM.

Keyless Entry Interior Illumination

When the operator uses the keyless entry transmitter in order to unlock the doors, the BCM receives a door-unlock signal. The BCM must receive inputs from various systems that indicate that the ignition switch is OFF, the courtesy lamp switch is OFF, and all doors are closed before the BCM will activate the interior lamps. After all doors have been closed, the courtesy lamps will turn OFF immediately if the ignition switch is turned to the ON position, the door locks are LOCKED, or approximately 20 seconds after the last door closes. The BCM will turn off the courtesy lamps through the theater dimming feature. The BCM keeps the courtesy lamps on for 40 seconds after an alarm event is completed.

Interior Lamps Dimming

The second group includes lamps which may be dimmed. This group may use a combination of light emitting diodes (LED), incandescent lamps, and pulse width modulation (PWM) illumination.

- Dome/reading lamps – front
- Dome/reading lamps – rear
- Door lock switch – driver
- Door lock switch – passenger
- Headlamp switch
- HVAC control head assembly
- Multifunction switch – instrument panel
- Outside rearview mirror switch
- Park brake switch
- Radio
- Roof beacon switch
- Seat memory switch – driver
- Steering wheel control switch – left
- Steering wheel control switch – right
- Sun roof switch
- Sun roof tilt switch

- Transfer case shift control switch
- Trailer brake control switch
- Window switch – driver
- Window switch – passenger

With the headlamp switch in the PARK or HEAD position, the park lamp switch signal circuit provides an input to the body control module (BCM). The BCM responds by applying voltage to the park lamps as well as the backlight dimming control circuits illuminating all components with interior backlighting. All interior backlighting turns ON at the dimming level indicated by the instrument panel dimmer switch. The instrument panel dimmer switch is a momentary type switch and utilizes a resistor ladder to increase and decrease the brightness of the interior backlighting components. The instrument panel dimmer switch provides a voltage signal to the BCM that will increase as the brightness of the lights are increased and decrease as the brightness of the lights are decreased. The BCM provides a low reference signal and a B+ circuit to the instrument panel dimmer switch. When the instrument panel dimmer switch is held in the desired position, the dimmed voltage setting is applied from the instrument panel dimmer switch through the instrument panel dimmer switch signal circuit to the BCM. The BCM interprets the signal and applies a pulse width modulated voltage through the backlighting control circuits illuminating the interior backlighting to the requested level of brightness.

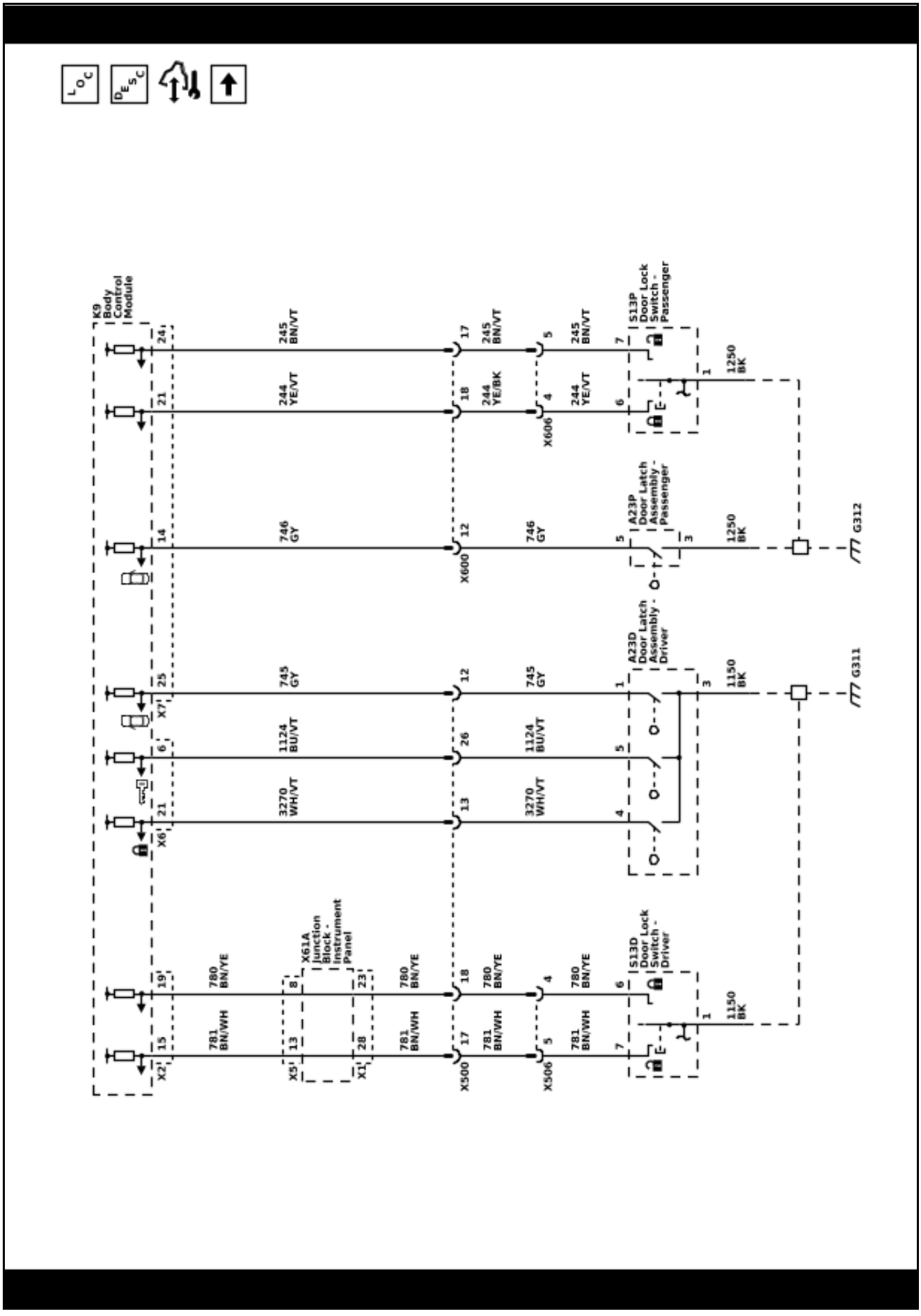
Battery Rundown Protection/ Inadvertent Power

The BCM inadvertent power supply voltage circuit provides battery voltage to all of the interior courtesy lamps. In the event that any of these lamps were to remain illuminated for a period of more than 10 minutes with the ignition switch in the OFF position, the BCM will deactivate the inadvertent power supply voltage circuit to prevent total battery discharge. If the ignition switch is turned to any position other than OFF, or if a lamp switch is activated during this 10 minute period, the timer resets for another 10 minutes.

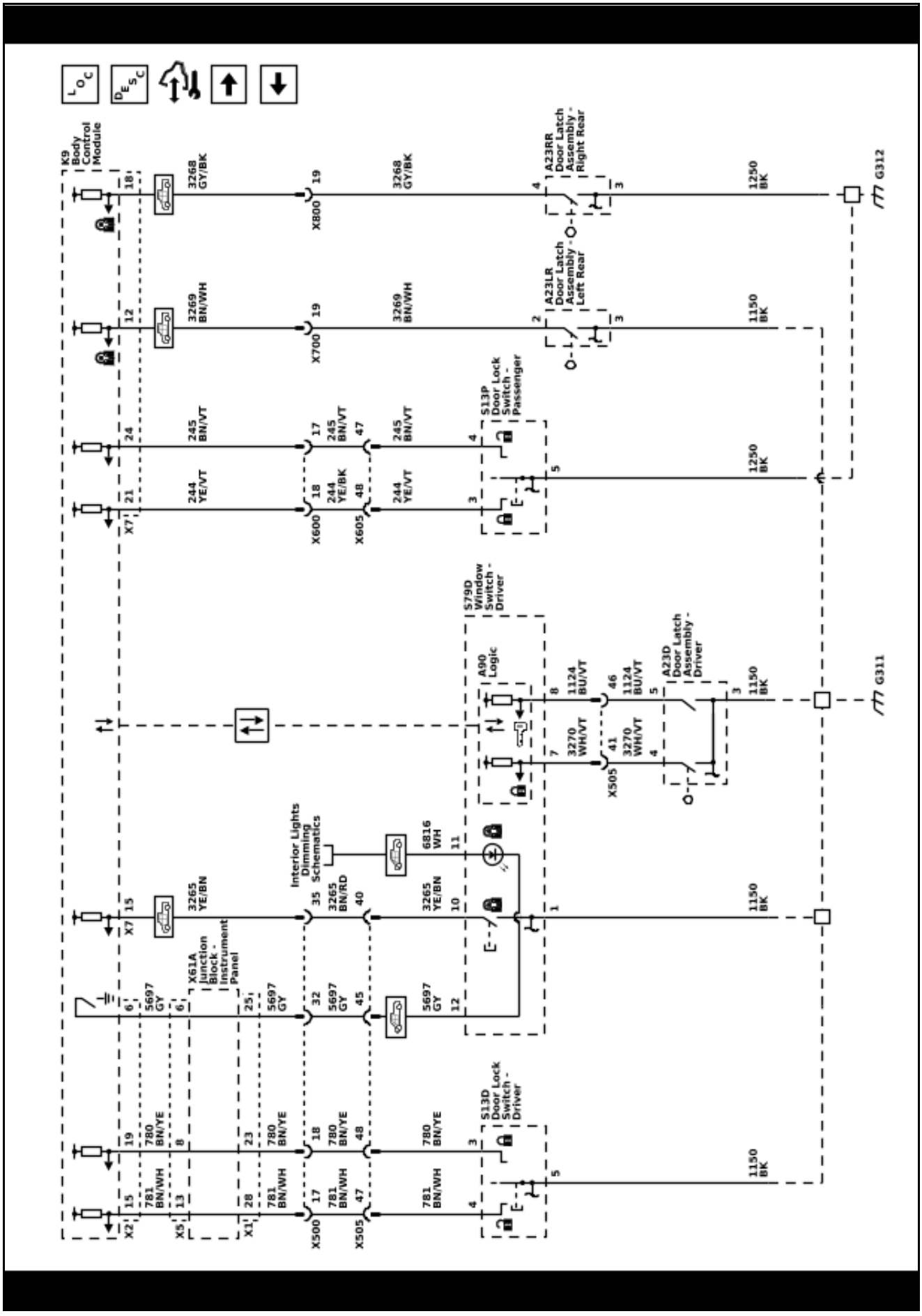
Vehicle Access

Schematic and Routing Diagrams

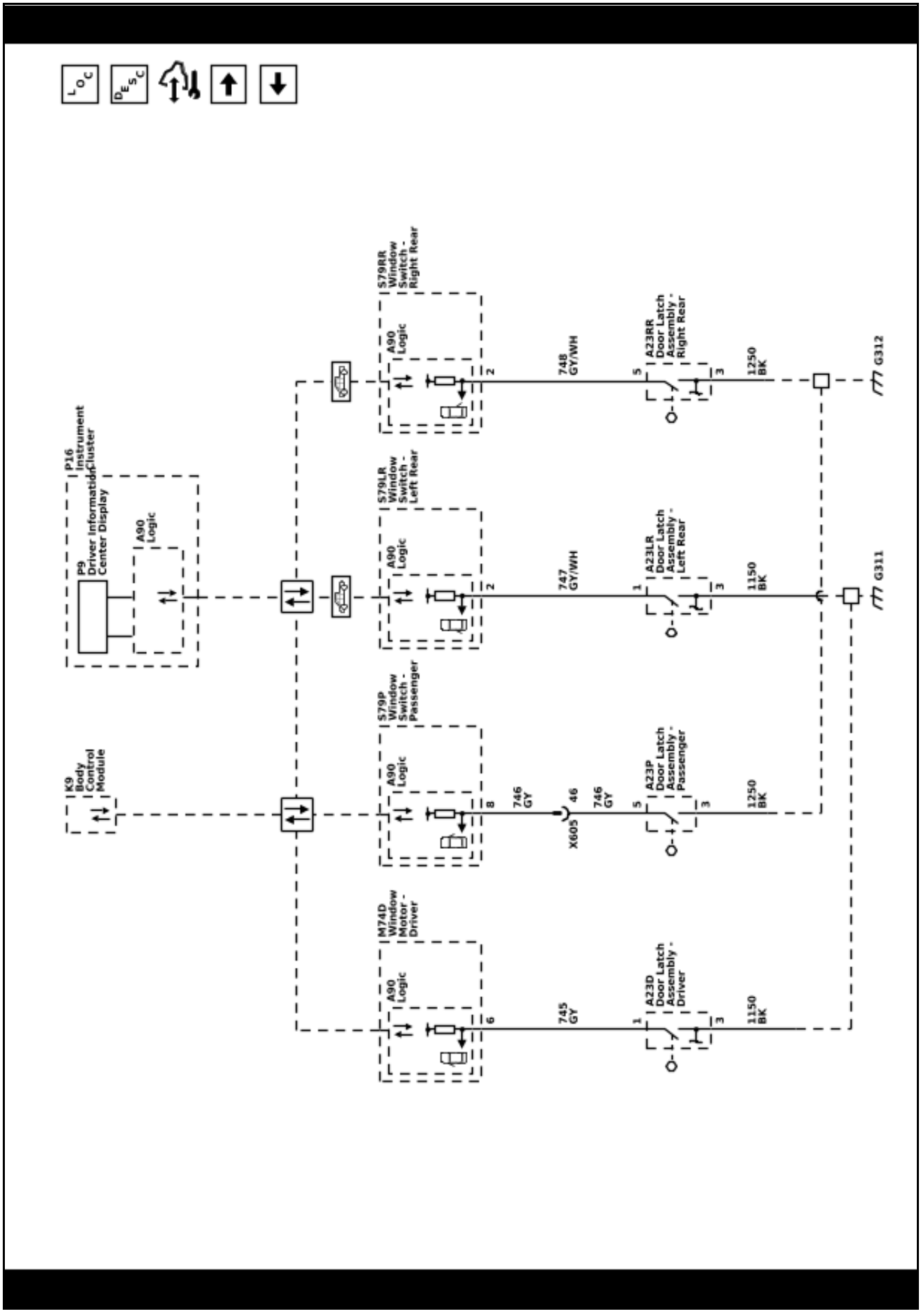
Door Lock/Indicator Schematics (Switches and Indicators (-A31))



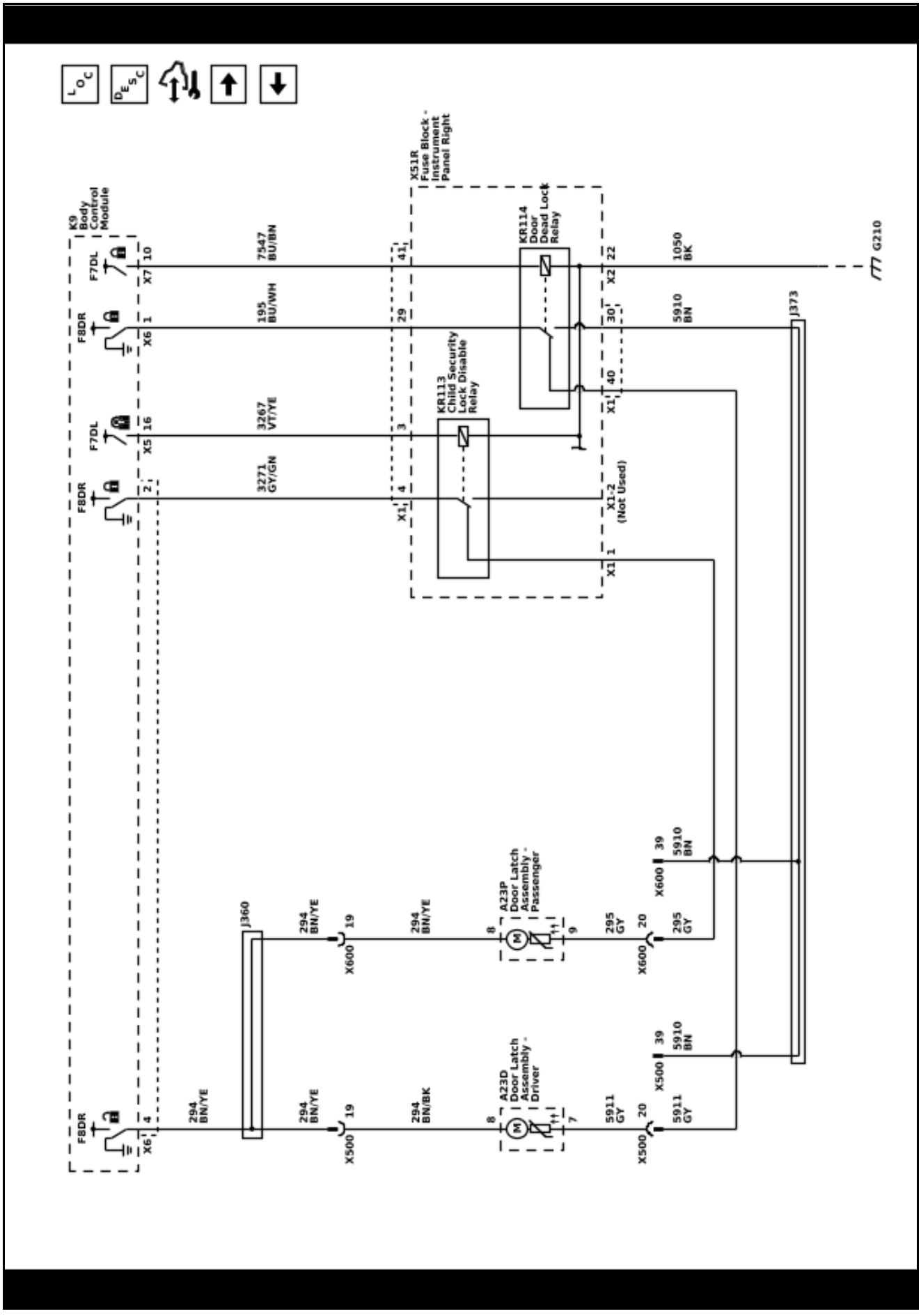
Door Lock/Indicator Schematics (Switches and Child Lock Status (A31))



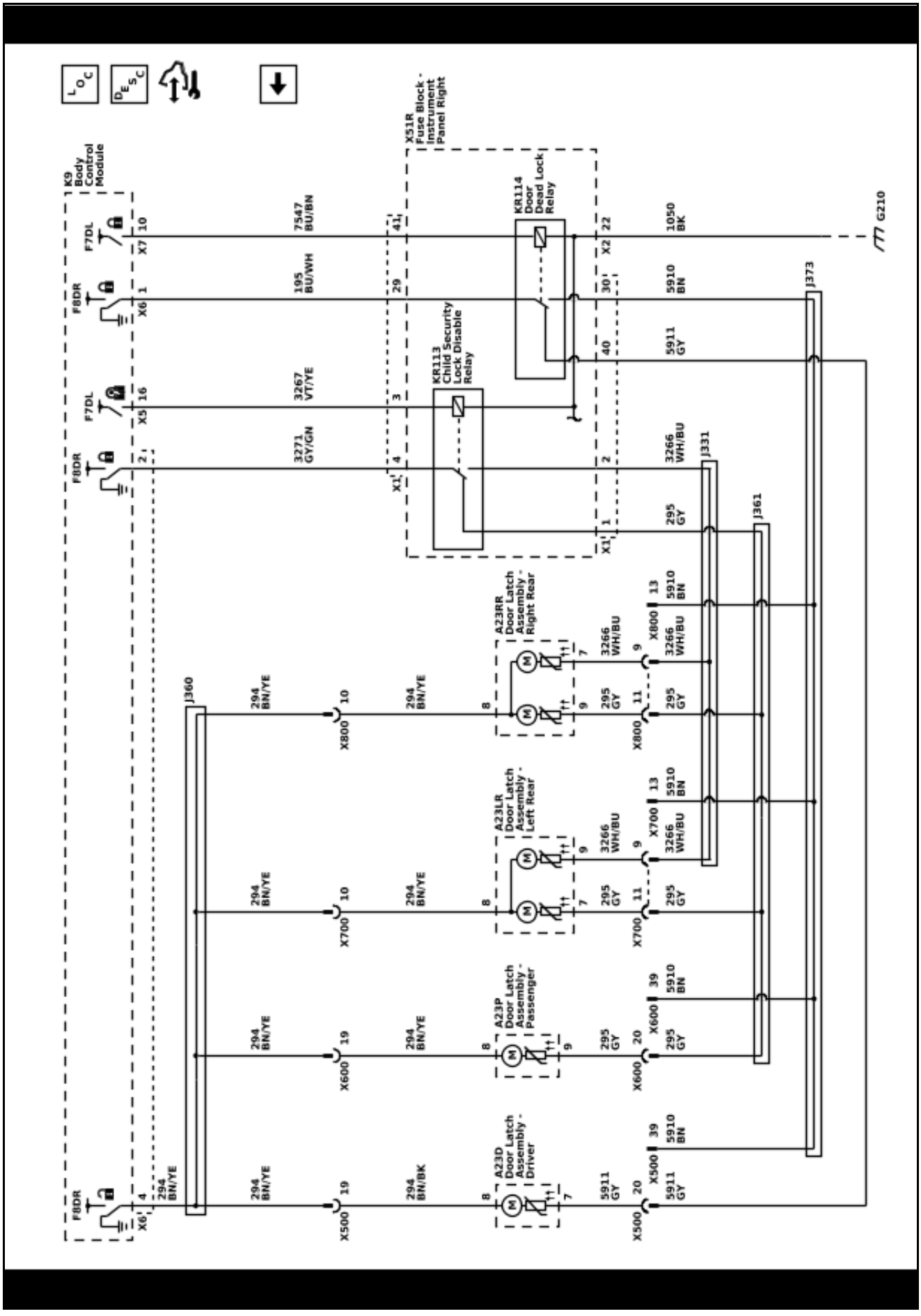
Door Lock/Indicator Schematics (Indicators (A31))



Door Lock/Indicator Schematics (Actuators (Standard Cab))

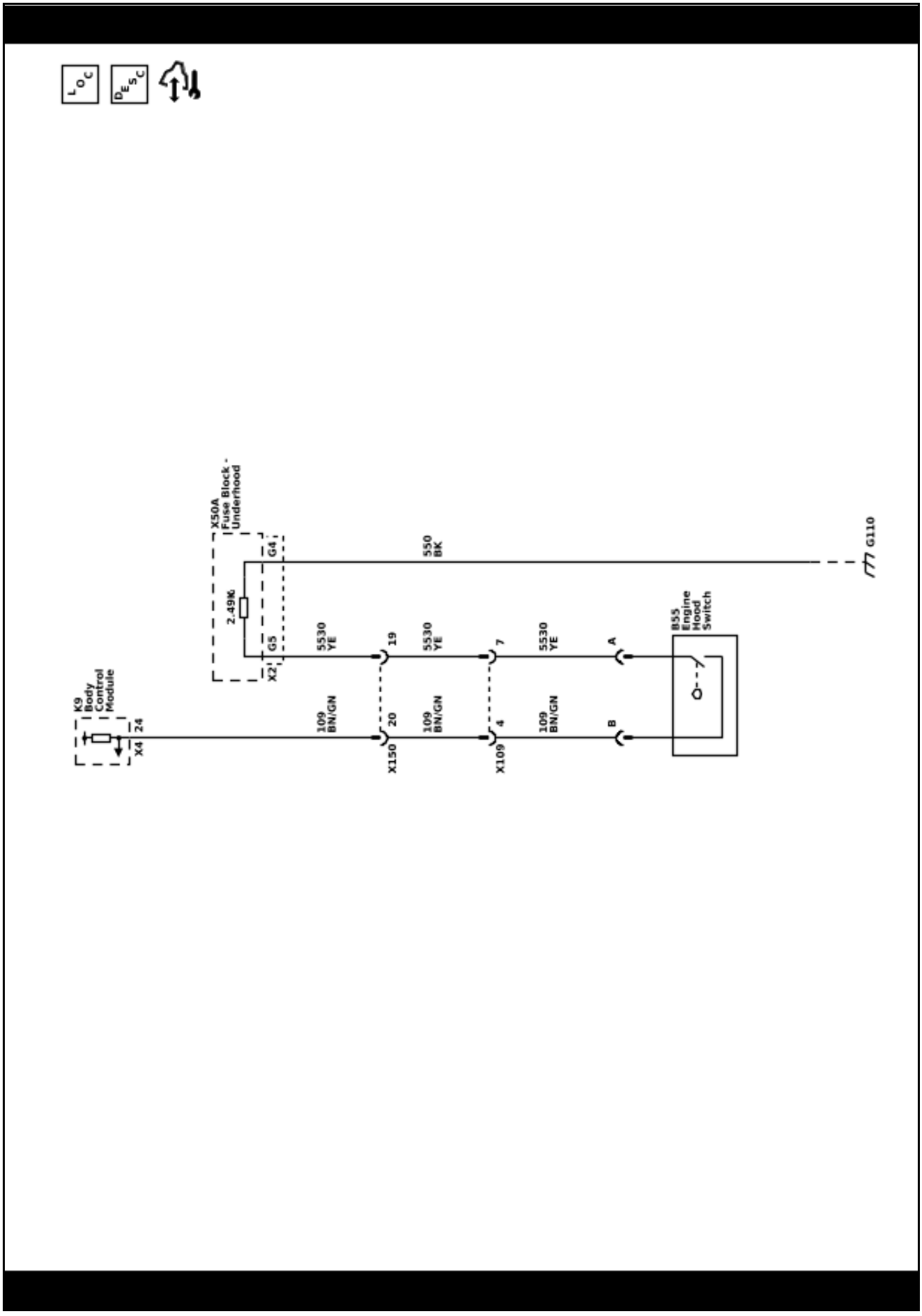


Door Lock/Indicator Schematics (Actuators (Crew Cab))



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Hood Latch Schematics (Hood Ajar Switch (BTV/PTO/UTJ))



Description and Operation

Door Ajar Indicator Description and Operation

Door Ajar Indicator System Components

The door ajar indicator system consists of the following components:

- Body control module
- Instrument cluster
- Driver door latch
- Passenger door latch
- Left rear door latch
- Right rear door latch
- Driver window motor (A31)
- Passenger window switch (A31)
- Left rear window switch (A31)
- Right rear window switch (A31)

Door Ajar System

Depending upon if the vehicle is a standard cab, extended cab or crew cab and/or is equipped with power windows or without power windows affects how the driver and passenger door ajar signal circuits are configured and monitored.

Driver Door Ajar (With A31)

The driver window motor will provide a 12V signal to the driver door ajar switch within the door latch to indicate the status of the door. When the driver door is open, the contract within the ajar switch closes providing a ground part for the signal circuit. The driver window motor will detect the voltage drop in the ajar signal circuit and will send a serial data message to the body control module. The body control module will then send a message to the instrument cluster which will illuminate the door ajar icon.

Passenger and Rear Doors Ajar (With A31)

The passenger and rear window switches provide a 12V signal to the respective door ajar switch within the door latch to indicate the status of the door. When the door is open, the contract within the ajar switch closes providing a ground part for the signal circuit. The window switch will detect the voltage drop in the ajar signal circuit and will send a serial data message to the body control module. The body control module will then send a message to the instrument cluster which will illuminate the door ajar icon.

Driver, Passenger and Rear Doors Ajar (Without A31)

The body control module provides a 12V signal to each door ajar switch within the door latch to indicate the status of the door. When the door is open, the contract within the ajar switch closes providing a ground part for the signal circuit. The body control module will detect the voltage drop in the ajar signal circuit and will send a message to the instrument cluster which will illuminate the door ajar icon

Hood Ajar Indicator Description and Operation

Hood Ajar Switch

The body control module (BCM) applies B+ to the hood ajar signal circuit and monitors the voltage to determine the position of the hood. When the hood is closed, the switch is open and voltage remains high. When the hood is open, the switch is closed and the voltage is pulled low.

The BCM uses the hood ajar switch as a content theft deterrent alarm trigger.

Hood Ajar Indicator/Message

When the hood is ajar, a message is displayed on the DIC or the hood ajar indicator will be illuminated.

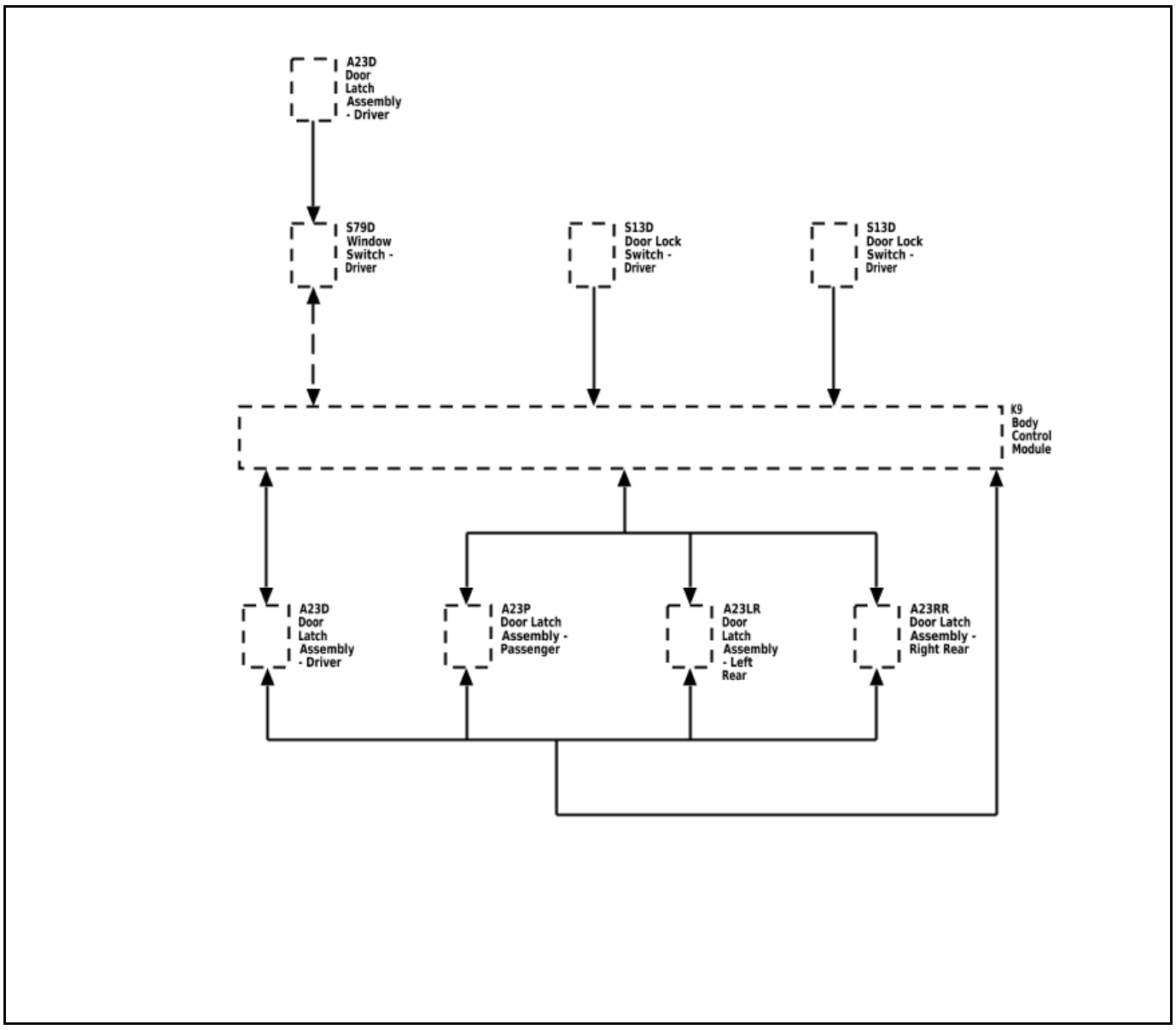
Power Door Locks Description and Operation

Door Lock System Components

The power door lock system consists of the following components:

- Driver door lock switch
- Child door lockout switch (Part of the driver window switch)
- Passenger door lock switch
- Front door lock actuators
- Rear door lock actuators (Extended and crew cab models)
- Body control module (BCM)
- Keyless entry control module
- Keyless entry transmitter
- Right instrument panel fuse block (Contains child security lock disable PCB relay)

Power Door Locks Block Diagram


A23D Door Latch Assembly - Driver
S79D Window Switch - Driver
S13D Door Lock Switch - Driver
S13D Door Lock Switch - Driver
K9 Body Control Module
A23D Door Latch Assembly - Driver
A23P Door Latch Assembly - Passenger
A23LR Door Latch Assembly - Left Rear
A23RR Door Latch Assembly - Right Rear

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Door Lock System Controls

The power door lock system can be controlled by any of the following:

- A door lock switch LOCK or UNLOCK activation
- A keyless entry transmitter activation

Door Lock Operation

The BCM supplies a 12 volt signal to the lock and unlock signal circuits of the driver and passenger door lock switches. When the appropriate switch is pressed, a contact within the door lock switch closes providing a ground path for the signal circuit. The BCM will detect the voltage drop in the signal and will command the doors to perform the lock or unlock functions.

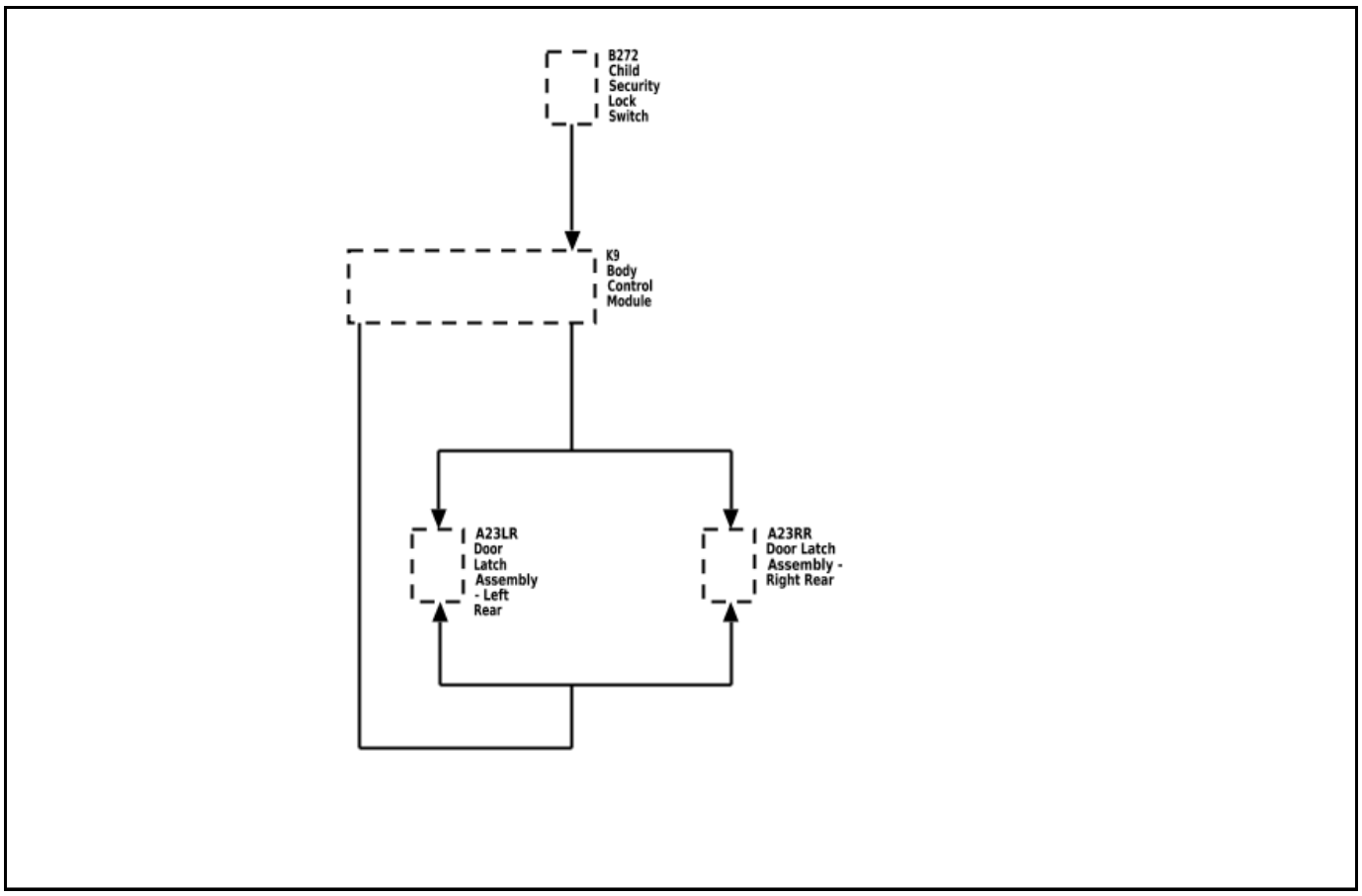
The BCM may also receive a LOCK or UNLOCK command from the keyless entry control module, refer to *Keyless Entry System Description and Operation on page 8-9* for information on the keyless entry system

The BCM, upon receipt of a lock switch lock or unlock signal, will supply voltage to the door lock actuator lock or unlock control circuits. Since the opposite side of the lock actuator is connected to ground through the other lock actuator control circuit, the doors will then lock or unlock as commanded.

The following three circuits are used to operate the lock:

- Driver door unlock
- Passenger doors unlock
- All doors lock

Power Door Child Lock Block Diagram



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Child Security Lockout System Operation

The child door lockout switch on the driver window switch controls the child locks on the rear doors. The lockout switch is an input to the body control module and the body control module controls the door lock security relay. When the body control module receives a command from the child door lockout switch, it will apply voltage to the child security lock disable relay coil, this will energize the relay and the contact within the relay will then direct the voltage to activate the left rear and right rear child locks and then isolate them from the normal door lock system to prevent the rear doors from being opened by using the interior rear door handles. An indicator will also illuminate to alert the driver that the child lockout system has been activated. Pushing the switch again will return normal function to the rear interior door handles and the indicator will go out.

The body control module monitors the voltage level of the child security motor status signal circuit, when the child locks have been activated, the contacts of the child security motor status switch (internal to the rear door latch) will close providing a ground path for the signal circuit pulling the voltage low. It is in this manner that the body control module is able to determine if the rear door latch has been successfully been locked out.

The body control module monitors the status of the child security lockout system, when the body control module detects a fault in the system, it will command the child lockout indicator to flash ON and OFF for 30 seconds to alert the driver that the child security lockout system may not be functioning properly.

The body control module will command the child lockout indicator to flash ON and OFF for the following reasons:

- An open/high resistance in either child security motor status signal circuit
- The body control module detects that one or both rear door latches have not activated and are not locked out
- The body control module detects a short to ground or an open/high resistance in the child security lock disable relay control circuit
- A malfunctioning child security lock disable relay
- An open/high resistance in the child security lock motor control circuit

Section 3

Brakes

Park Brake 3-3
Description and Operation 3-3
Park Brake System Description and Operation 3-3

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Park Brake

Description and Operation

Park Brake System Description and Operation

System Component Description

The park brake system consists of the following:

Park Brake Pedal Assembly: Receives and transfers park brake system apply input force from driver to park brake cable system. Releases park brake system apply force on vehicles without a park brake release handle through the partial application of the park brake pedal.

Park Brake Release Handle Assembly (If equipped): Releases applied park brake system when pulled.

Park Brake Cables: Transfers input force received from park brake pedal, through the park brake cable , to park brake apply lever.

Park Brake Apply Pedal: Multiplies and transfers input force to park brake actuator.

Park Brake Actuator/Adjuster: Uses multiplied input force from apply lever to expand park brake shoe toward the friction surface of the park brake drum.

Star wheel park brake actuators are also used to control clearance between the park brake shoe and the friction surface of the park brake drum.

Park Brake Shoe: Applies mechanical output force from park brake actuator to friction surface of the drum in the park brake drum.

System Operation

The parking brake is a single drum design, mounted around the propeller shaft, forward of the rear differential. When the parking brake pedal is depressed, the parking cable is pulled, overcoming spring pressure within the parking brake and pushing the brake shoes into contact with the inside of the parking brake drum. When the operator disengages the parking brake pedal, spring tension in the parking brake pulls the park brake shoes to their original (disengaged) position. The parking brake self-adjusts for brake shoe wear by using a star wheel mechanism.

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Section 4

Driver Information and Entertainment

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Image Display Camera Schematics 4-4
Description and Operation 4-6
Rear Vision Camera Description and Operation (with IOB/IOR/IO3) 4-6
Rear Vision Camera Description and Operation (with IO5/IO6) 4-6

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Image Display Cameras

Schematic and Routing Diagrams

Image Display Camera Schematics (Rearview Camera (UVC+IOB/IO3))

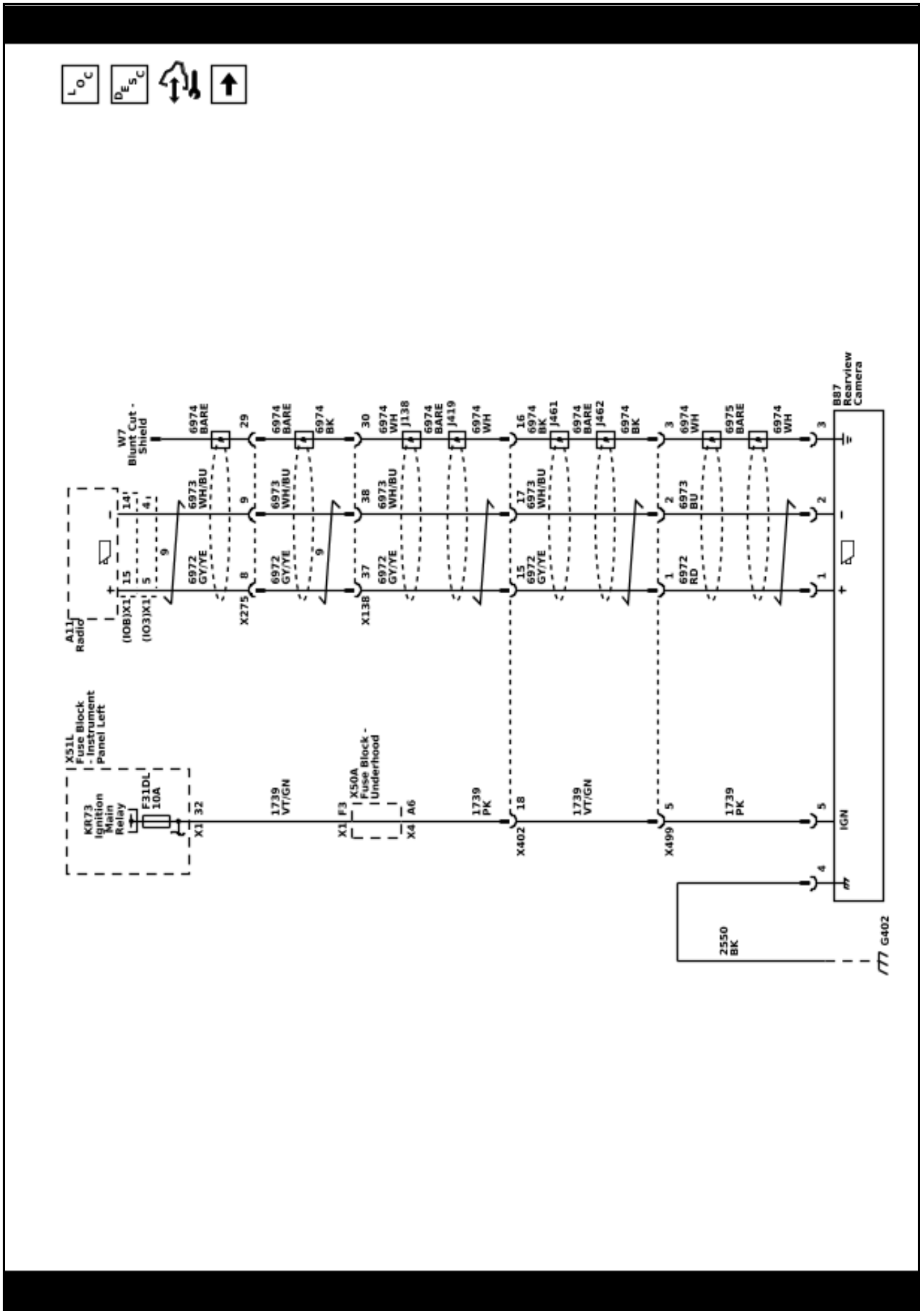
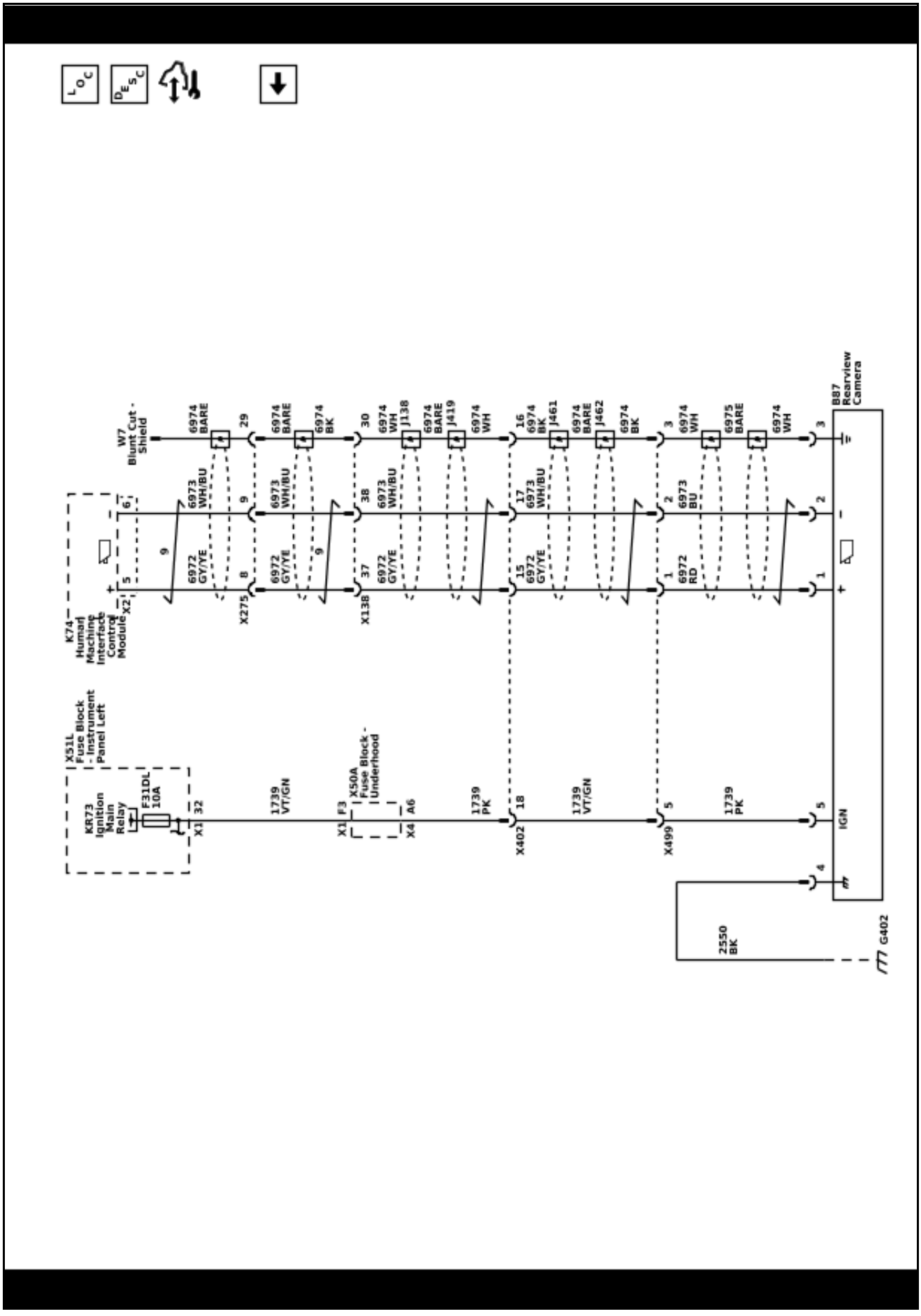


Image Display Camera Schematics (Rearview Camera (UVC+IO5))



Description and Operation

Rear Vision Camera Description and Operation (with IOB/IOR/IO3)

Rear Vision Camera System Operation

The rear vision camera system consists of a video camera located at the rear of the vehicle and the Rado.

When the transmission is placed into REVERSE, a signal indicates to the Radio that the vehicle is in reverse and image display is requested. The rear vision camera receives ignition voltage and a constant ground to power the camera. Video signal + and video signal – circuits carry the video image from the rear vision camera to the radio. Additionally, the video signal circuits are shielded to prevent any interference which may lead to a loss of video signal resolution and a degraded video image. The shield is provided a ground path by the rear vision camera.

The following conditions may cause a degraded rear vision camera image:

- Ice, snow, or mud has built up on the rear vision camera
- Dark conditions
- Extreme light conditions, such as glare from the sun or the headlights of another vehicle
- Damage to the rear of the vehicle
- Extreme high temperatures or extreme temperature changes

If a malfunction is detected in the system, Service Rear Vision Camera may be displayed on the Info Display Module as an indicator to the customer that a problem exists that requires service.

Rear Vision Camera Description and Operation (with IO5/IO6)

Rear Vision Camera System Operation

The rear vision camera system consists of a video camera located at the rear of the vehicle and the Human Machine Interface Control Module.

When the transmission is placed into REVERSE, a signal indicates to the Human Machine Interface Control Module that the vehicle is in reverse and image display is requested. The rear vision camera receives ignition voltage and a constant ground to power the camera. Video signal + and video signal – circuits carry the video image from the rear vision camera to the Human Machine Interface Control Module. Additionally, the video signal circuits are shielded to prevent any interference which may lead to a loss of video signal resolution and a degraded video image. The shield is provided a ground path by the rear vision camera.

The following conditions may cause a degraded rear vision camera image:

- Ice, snow, or mud has built up on the rear vision camera
- Dark conditions
- Extreme light conditions, such as glare from the sun or the headlights of another vehicle
- Damage to the rear of the vehicle
- Extreme high temperatures or extreme temperature changes

If a malfunction is detected in the system, Service Rear Vision Camera may be displayed on the Info Display Module as an indicator to the customer that a problem exists that requires service.

Section 5

Engine/Propulsion

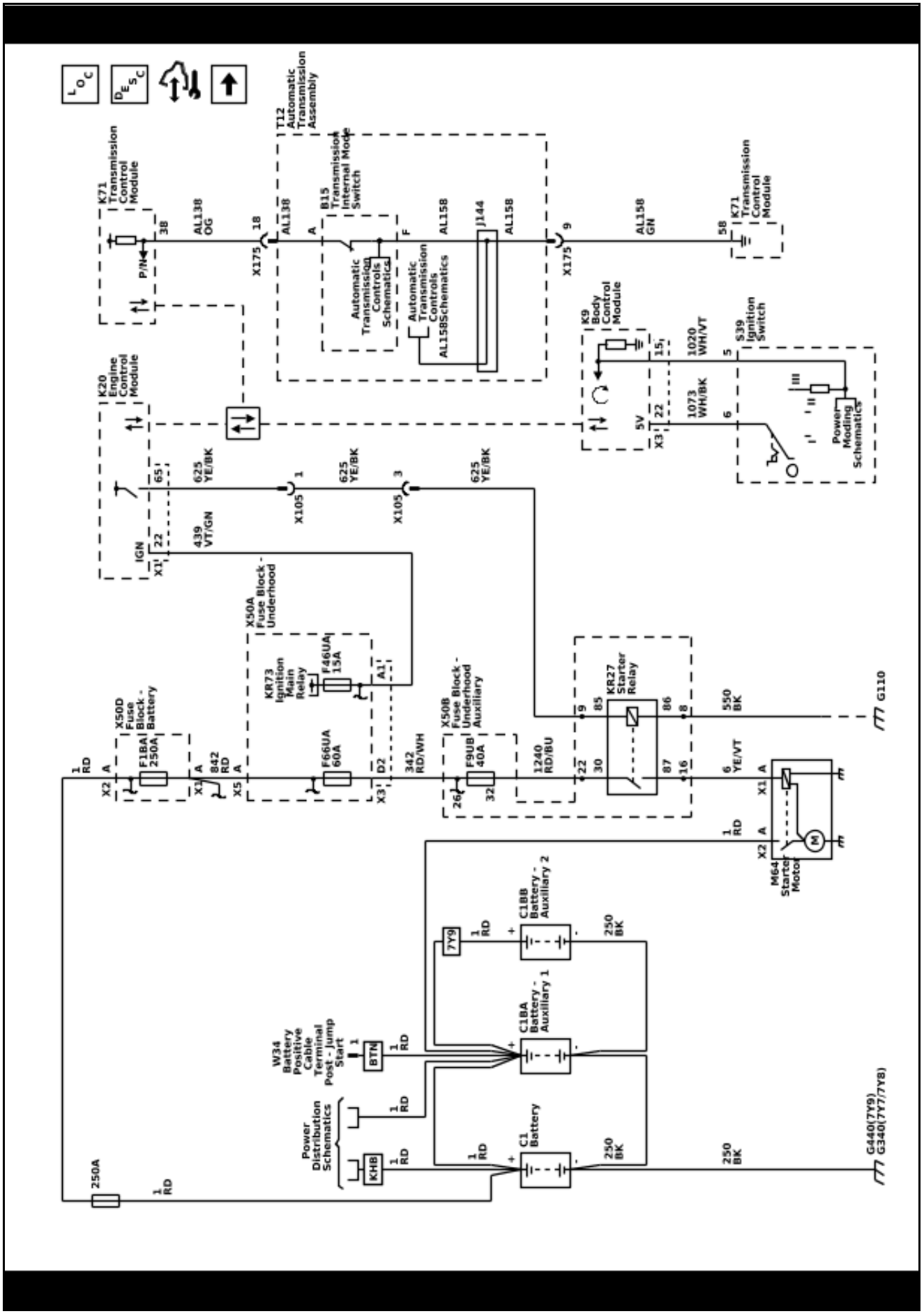
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Battery Description and Operation 5-6
Charging System Description and Operation 5-6
Electrical Power Management Description and Operation (Gasoline) 5-10
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Starting System Description and Operation 5-12

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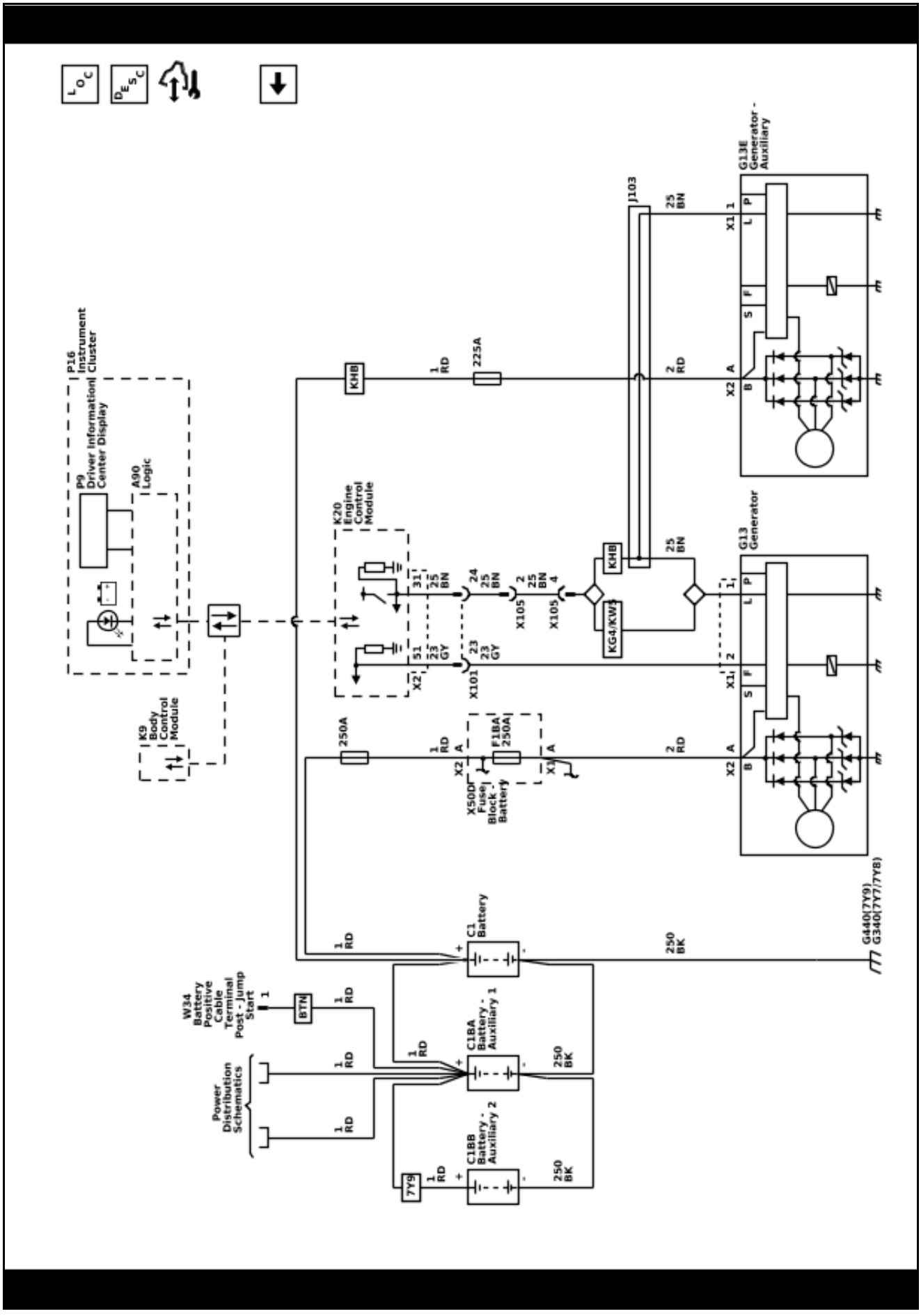
12 V Starting and Charging

Schematic and Routing Diagrams

Starting and Charging Schematics (Starting)



Starting and Charging Schematics (Charging)



Description and Operation

Battery Description and Operation

Warning: Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- ***Always shield your eyes and avoid leaning over the battery whenever possible.***
- ***Do not expose the battery to open flames or sparks.***
- ***Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.***
- ***Follow each step of the jump starting procedure in order.***
- ***Treat both the booster and the discharged batteries carefully when using the jumper cables.***

Batteries that are no longer wanted must be disposed of by an approved battery recycler and must never be thrown in the trash or sent to a landfill.

Batteries that are not part of the vehicle itself, not the battery under the hood, must only be transported on public streets for business purposes via approved hazardous material transportation procedures.

Battery storage, charging and testing facilities in repair shops must meet various requirements for ventilation, safety equipment, material segregation, etc.

The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for 2 small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

The battery has 3 functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload

Battery Low Start Vehicle Message

The body control module (BCM) monitors battery positive voltage to determine battery state of charge. If one or more of the BCM battery positive voltage terminals measure less than approximately 11.6V compared to the BCM ground circuits, this message will display and four chimes may sound. Start the vehicle immediately. If the vehicle is not started and the battery continues to discharge, the climate controls, heated seats, and audio systems will shut off and the vehicle may require a jump start. These systems will function again after the vehicle is started.

Battery Ratings

A battery has 2 ratings:

- Cold cranking amperage
- Amperage hours

When a battery is replaced use a battery with similar ratings. See battery specification label on the original battery.

Amperage Hours

The amperage hour rating tells you how much amperage is available when discharged evenly over a 20 hour period. The amperage hour rating is cumulative, so in order to know how many constant amperage the battery will output for 20 h, you have to divide the amperage hour rating by 20. Example: If a battery has an amperage hour rating of 74, dividing by 20 = 3.75. Such a battery can carry a 3.75 A load for 20 hours before dropping to 10.5 V. (10.5 V is the fully discharged level, at which point the battery needs to be recharged.) A battery with an amperage hour rating of 55 will carry a 2.75 A load for 20 hours before dropping to 10.5 V.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at −18°C (0°F) while maintaining at least 7.2 V. See battery label for the cold cranking amperage rating of this battery.

Charging System Description and Operation

Electrical Power Management Overview

The electrical power management system is designed to monitor and control the charging system and send diagnostic messages to alert the driver of possible problems with the battery and generator. This electrical power management system primarily utilizes existing on-board computer capability to maximize the effectiveness of the generator, to manage the load, improve battery state-of-charge and life, and minimize the system's impact on fuel economy. The electrical power management system performs 3 functions:

- Monitor the battery voltage and estimate the battery condition
- Take corrective actions by boosting idle speeds, and adjusting the regulated voltage
- Perform diagnostics and driver notification

The battery condition is estimated during ignition/vehicle off and during ignition/vehicle on. During ignition/vehicle off the state-of-charge of the battery is determined by measuring the open-circuit voltage. The state-of-charge is a function of the acid concentration and the internal resistance of the battery, and is estimated by reading the battery open circuit voltage when the battery has been at rest for several hours.

Any time the ignition/vehicle is on, the vehicle algorithm continuously estimates battery state-of-charge based on adjusted net amp hours, battery capacity, initial state-of-charge, and calculated temperature.

While the engine is running, the battery degree of discharge is primarily determined by the integrated battery current sensor, to obtain net amp hours.

In addition, the electrical power management function is designed to perform regulated voltage control to improve battery state-of-charge, battery life, and fuel economy. This is accomplished by using knowledge of the battery state-of-charge and temperature to set the charging voltage to an optimum battery voltage level for recharging without detriment to battery life.

Charging System Components

Generator

The engine drive belt drives the generator. When the rotor is spun, it induces an alternating current (AC) into the stator windings. The AC voltage is then sent through a series of diodes for rectification. The rectified voltage has been converted into a direct current (DC) for use by the vehicles electrical system to maintain electrical loads and the battery charge. The voltage regulator integral to the generator controls the output of the generator; It is not serviceable. The voltage regulator controls the amount of current provided to the rotor. If the generator has field control circuit fault, the generator defaults to an output voltage of 13.8 V.

The generator is serviced as a complete assembly. If there is a diagnosed fault in the generator, it must be replaced as an assembly.

Generator Pulley

The pulley drives the Generator via the engine drive belt. There are 2 types of pulleys:

1. Conventional solid Pulley which is bolted to the Generator stator shaft. This Pulley can be serviced separately.

2. One Way Clutch Pulley or Overrunning Alternator Decoupler Pulley allows the Generator to spin freely when the engine rapidly slows down on sudden deceleration. This part is not serviceable and the Generator needs to be replaced as an assembly.

Body Control Module (BCM)

The BCM communicates with the Engine Control Module (ECM) and the instrument cluster for electrical power management operation. The BCM determines the output of the generator and sends the information to the ECM for control of the generator turn on signal circuit. It monitors the generator field duty cycle signal circuit information sent from the ECM for control of the generator. It monitors the battery current sensor, the battery positive voltage circuit, and estimates battery temperature to determine battery state of charge. The BCM also performs idle boost.

Battery Current Sensor (if applicable)

The Battery Current Sensor is a serviceable component that is connected to the negative battery cable at the battery. The battery current sensor is a 3-wire hall effect current sensor. The battery current sensor monitors the battery current. It directly inputs to the BCM. It creates a 5 volt Pulse Width Modulation (PWM) signal of 128 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–95%. Between 0–5% and 95–100% are for diagnostic purposes.

Battery Sensor Module (if applicable)

The BCM monitors the Battery Sensor Module for battery state of current, state of health, and battery charge via serial data. If the battery is determined to be in poor state of health or having a low state of charge, the BCM will not allow the ECM to perform an auto-stop.

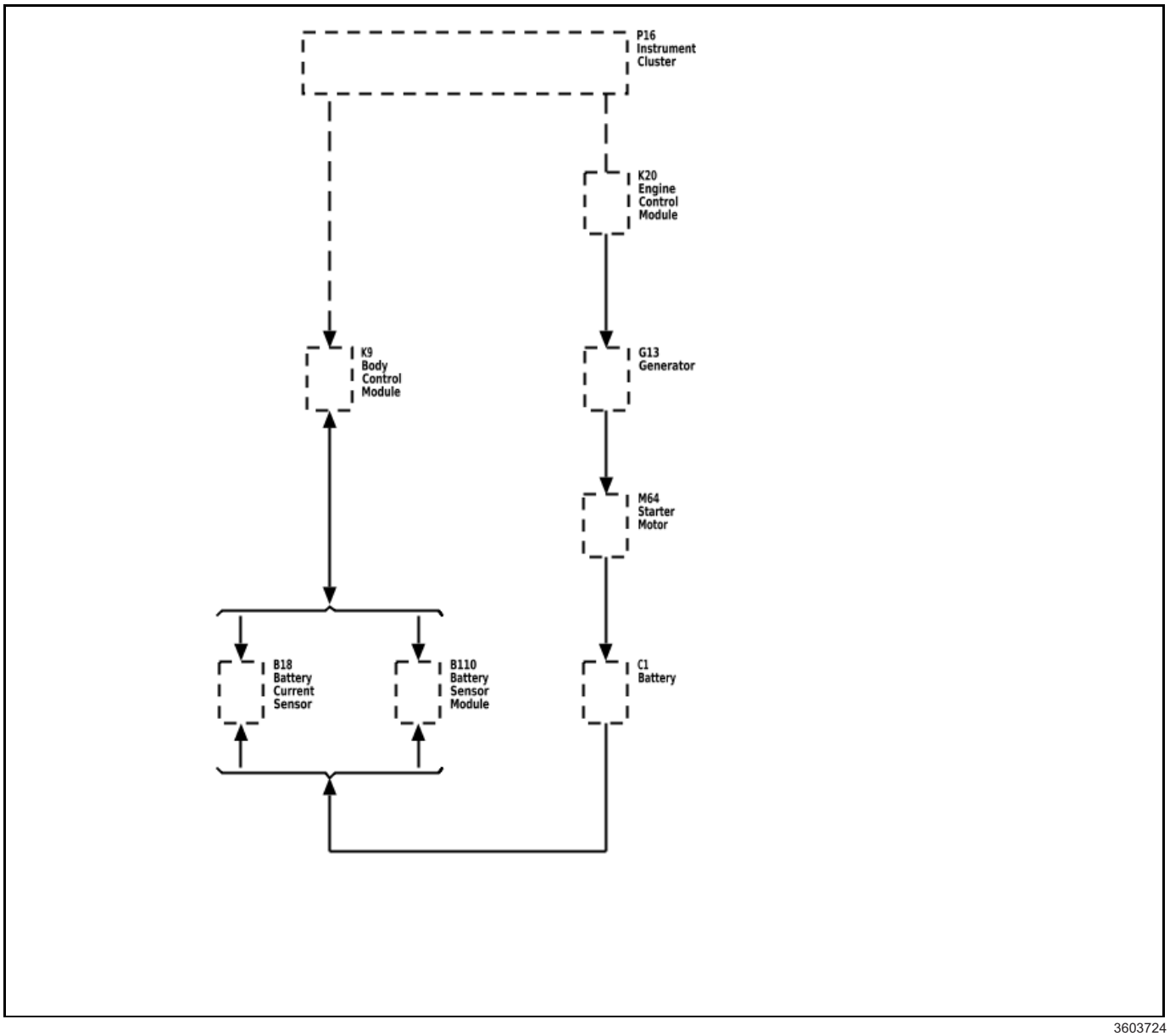
Engine Control Module (ECM)

When the engine is running, the generator turn-on signal is sent to the generator from the ECM, turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation. The generator field duty terminal is connected internally to the voltage regulator and externally to the ECM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the ECM that a problem exists. The ECM monitors the generator field duty cycle signal circuit, and receives control decisions based on information from the BCM.

Instrument Cluster

As a means of displaying the charging system functions, some vehicles may be equipped with a voltmeter gauge on the instrument cluster and/or a system voltage display in the driver information center. These will indicate the current vehicle system voltage.

The instrument cluster also provides customer notification if there is a concern with the charging system. There are two means of notification: a charge indicator on the instrument cluster and/or a service system message displayed on the Driver Information Center (DIC) if equipped.



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Charging System Operation

The purpose of the charging system is to maintain the battery charge and vehicle loads. There are 6 modes of operation and they include:

- Battery Sulfation Mode
- Charge Mode
- Fuel Economy Mode
- Head lamp Mode
- Start Up Mode
- Voltage Reduction Mode

The ECM Controls the Generator through the generator turn–on signal circuit, also known as the Generator L-terminal. The ECM monitors the generator performance though the Generator field duty cycle signal circuit, also known as the generator F-terminal.

The Generator turn–on signal (Generator L-terminal) is a Pulse Width Modulation (PWM) signal of 128 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–95%. 0–5% and 95–100% are for diagnostic purposes, with 0–5% monitoring for an open circuit and 95–100% monitoring for a short to ground at a fixed 13.8 V. The following table shows the commanded duty cycle and output voltage of the Generator:

Commanded Duty Cycle	Generator Output Voltage (+/- .25 V)
0–5%	13.8 V
10%	11 V
20%	11.56 V
30%	12.13 V
40%	12.69 V
50%	13.25 V
60%	13.81 V
70%	14.38 V
80%	14.94 V
90%	15.5 V
95–100%	13.8 V

The Generator provides a PWM feedback signal of the Generator voltage output through the Generator field duty cycle signal circuit to the ECM. This information is sent to the Body Control Module (BCM). The Generator field duty cycle signal (Generator F-terminal) is a PWM signal of 60–460 Hz with a duty cycle of 0–100%. Normal duty cycle is between 5–100%. 0–5% is reserved for diagnostic purposes.

As the charging systems works to maintain the battery charge and manage vehicle electrical loads, it is normal for the voltmeter gauge on the instrument cluster or the system voltage displayed in the DIC to fluctuate or change. This does not indicate a malfunction. Depending on the battery state of charge and the vehicle electrical load, these values may be anywhere from 12.5 V to 15.5 V.

Charging System Modes

Battery Sulfation Mode

The BCM will enter this mode when the interpreted Generator output voltage is less than 13.2 V for 45 minutes. When this condition exists the BCM will enter Charge Mode for 2–3 minutes. The BCM will then determine which mode to enter depending on voltage requirements.

Charge Mode

The BCM will enter Charge Mode when ever one of the following conditions are met:

- Windshield wipers are ON for more than 3 s.
- Climate Control Voltage Boost Mode Request is true, as sensed by the HVAC control module via serial data. High speed cooling fan, rear defogger, and HVAC high speed blower operation can cause the BCM to enter the Charge Mode.
- The estimated battery temperature is less than 0° C (32°F).
- Battery State of Charge is less than 80%.
- Vehicle speed is greater than 145 km/h (90 mph)
- A current sensor malfunction exists.
- System voltage is determined to be below 12.56 V

When any one of these conditions is met, the system will set targeted generator output voltage to a charging voltage between 13.9–15.5 V, depending on the battery state of charge and estimated battery temperature.

Fuel Economy Mode

The BCM will enter Fuel Economy Mode when the estimated battery temperature is at least 0°C (32°F) but less than or equal to 80°C (176°F), the calculated battery current is less than 15 A and greater than −8 A, and the battery state-of-charge is greater than or equal to 80%. Its targeted generator output voltage is the open circuit voltage of the battery and can be between 12.5–13.1 V. When fuel economy mode is active, the generator is not charging, only maintaining open circuit battery voltage. The BCM will exit this mode and enter Charge Mode when any of the conditions described above are present.

Headlamp Mode

The BCM will enter Headlamp Mode when ever the head lamps are ON (high or low beams). Voltage will be regulated between 13.9–14.5 V.

Start Up Mode

When the engine is started the BCM sets a targeted generator output voltage of 14.5 V for 30 s.

Tow/Haul Mode (if applicable)

Pressing the Tow/Haul Mode button located on the center stack, the vehicle system voltage is raised and the remote (non-vehicle) battery will be charged. Having the headlamps on will raise the system voltage and if the Tow/Haul button is applied it will not serve any purpose. The voltage is regulated between 13.9-14.5 V.

Instrument Cluster Operation

Charge Indicator Operation

The instrument cluster illuminates the charge indicator and displays a warning message in the driver information center if equipped, when the one or more of the following occurs:

- The ECM detects that the generator output is less than 11 V or greater than 16 V. The instrument cluster receives a serial data message from the ECM requesting illumination.
- The instrument cluster determines that the system voltage is less than 11 V or greater than 16 V for more than 30 s. The instrument cluster receives a serial data message from the BCM indicating there is a system voltage range concern.
- The instrument cluster performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 s.

Driver Information Center Message: BATTERY NOT CHARGING SERVICE CHARGING SYSTEM or SERVICE BATTERY CHARGING SYSTEM

The BCM and the ECM will send a serial data message to the driver information center for the BATTERY NOT CHARGING SERVICE CHARGING SYSTEM or SERVICE BATTERY CHARGING SYSTEM message to be displayed. It is displayed when a charging system DTC is a current DTC. The message is turned off when the conditions for clearing the DTC have been met.

Voltmeter Gauge and/or System Voltage Display (if equipped)

As a means of displaying the charging system functions, some vehicles may be equipped with a voltmeter gauge on the instrument cluster and/or a system voltage display in the driver information center. These will indicate the current vehicle system voltage.

As the charging systems works to maintain the battery charge and manage vehicle electrical loads, it is normal for the voltmeter gauge on the instrument cluster or the system voltage display in the driver information center to fluctuate or change. This does not indicate a malfunction. Depending on the battery state of charge and the vehicle electrical load, these values may be anywhere from 12.5 V to 15.5 V.

Electrical Power Management Description and Operation (Gasoline)

The electrical power management is used to monitor and control the charging system and alert the driver of possible problems within the charging system. The electrical power management system makes the most efficient use of the generator output, improves the battery state-of-charge, extends battery life, and manages system electrical loads.

The load shed operation is a means of reducing electrical loads during a low voltage or low battery state-of-charge condition.

The idle boost operation is a means of improving generator performance during a low voltage or low battery state-of-charge condition.

Each electrical power management function, either idle boost or load shed, is discrete. No two functions are active at the same time. Idle boost is activated in incremental steps, idle boost 1 must be active before idle boost 2 can be active. The criteria used by the body control module (BCM) to regulate electrical power management are outlined below:

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 1 Start	Less Than −15°C (5°F)	Less Than 13 V	—	First level Idle boost requested
Idle Boost 1 Start	—	—	Battery has a net loss greater than 0.6 AH	First level Idle boost requested
Idle Boost 1 Start	—	Less Than 10.9 V	—	First level Idle boost requested
Idle Boost 1 End	Greater Than −15°C (5°F)	Greater Than −12 V	Battery has a net loss less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	—	—	Battery has a net loss of 4 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 End	—	Greater Than 12 V	Battery has a net loss of less than 2 AH	Clear Load Shed 1
Idle Boost 2 Start	—	—	Battery has a net loss greater than 1.6 AH	Second level Idle boost requested
Idle Boost 2 Start	—	Less Than 10.9 V	—	Second level Idle boost requested
Idle Boost 2 End	—	Greater Than 12 V	Battery has a net loss less than 0.8 AH	Second level Idle boost request cancelled
Idle Boost 3 Start	—	—	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	—	Less Than 10.9 V	—	Third level Idle boost requested
Idle Boost 3 End	—	Greater Than 12 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled
Load Shed 2 Start	—	Less Than 10.9 V	Battery has a net loss greater than 12 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
				ACTIVE message will be displayed on the DIC
Load Shed 2 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 End	—	Greater Than 12.6 V	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	—	Less Than 11.9 V	Battery has a net loss greater than 20 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 100% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 3 End	—	Greater Than 12.6 V	Battery has a net loss of less than 15 AH	Clear Load Shed 3

Electrical Power Management Description and Operation (Diesel)

The electrical power management is used to monitor and control the charging system and alert the driver of possible problems within the charging system. The electrical power management system makes the most efficient use of the generator output, improves the battery state-of-charge, extends battery life, and manages system electrical loads.

The load shed operation is a means of reducing electrical loads during a low voltage or low battery state-of-charge condition.

The idle boost operation is a means of improving generator performance during a low voltage or low battery state-of-charge condition. Idle boost consists of three steps: idle boost 1, idle boost 2, and idle boost 3 (approximately 750, 900, and 1050 rpm respectively). Idle boost is activated in incremental steps, idle boost 1 must be active before idle boost 2 can be active.

Each electrical power management function, either idle boost or load shed, is discrete. No two functions are active at the same time. The criteria used by the body control module (BCM) to regulate electrical power management are outlined below:

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 1 Start	Less Than −15°C (5°F)	Less Than 13 V	—	First level Idle boost requested
Idle Boost 1 Start	—	—	Battery has a net loss greater than 0.6 AH	First level Idle boost requested
Idle Boost 1 Start	—	Less Than 10.9 V	—	First level Idle boost requested
Idle Boost 1 End	Greater Than −15°C (5°F)	Greater Than −12 V	Battery has a net loss less than 0.2 AH	First level Idle boost request cancelled
Load Shed 1 Start	—	—	Battery has a net loss of 4 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 20% of their cycle
Load Shed 1 End	—	Greater Than 12 V	Battery has a net loss of less than 2 AH	Clear Load Shed 1
Idle Boost 2 Start	—	—	Battery has a net loss greater than 1.6 AH	Second level Idle boost requested
Idle Boost 2 Start	—	Less Than 10.9 V	—	Second level Idle boost requested

Function	Battery Temperature Calculation	Battery Voltage Calculation	Amp-Hour Calculation	Action Taken
Idle Boost 2 End	—	Greater Than 12 V	Battery has a net loss less than 0.8 AH	Second level Idle boost request cancelled
Idle Boost 3 Start	—	—	Battery has a net loss of 10.0 AH	Third level Idle boost requested
Idle Boost 3 Start	—	Less Than 10.9 V	—	Third level Idle boost requested
Idle Boost 3 End	—	Greater Than 12 V	Battery has a net loss of less than 6.0 AH	Third level Idle boost request cancelled
Load Shed 2 Start	—	Less Than 10.9 V	Battery has a net loss greater than 12 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 Start	—	Less Than 10.9 V	—	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 50% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 2 End	—	Greater Than 12.6 V	Battery has a net loss of less than 10.5 AH	Clear Load Shed 2
Load Shed 3 Start	—	Less Than 11.9 V	Battery has a net loss greater than 20 AH	Rear Defrost, Heated Mirrors, Heated Seats cycled OFF for 100% of their cycle. The BATTERY SAVER ACTIVE message will be displayed on the DIC
Load Shed 3 End	—	Greater Than 12.6 V	Battery has a net loss of less than 15 AH	Clear Load Shed 3

Starting System Description and Operation

Starter Motor Operation (Without KL9)

The starter motors are non-repairable. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding because battery voltage is applied to both ends of the windings. The hold-in winding remains energized. Its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened.

When the crank signal is removed, the starter relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, causes the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Enhanced Starter Motor Operation (KL9)

The Engine Stop/Start system in GM vehicles automatically turns off the engine when the vehicle comes to a stop under certain driving conditions, and can quickly restart the engine in about 0.3 seconds when commanded to do so.

In order to smoothly restart the engine as quickly as possible while managing the greater number of engine starts, the Stop/Start system uses an enhanced starter motor that operates differently from a conventional

starter motor. It has a high performance electric motor and a stronger pinion engagement mechanism than a conventional starter. It also has independent control of the pinion and motor.

The enhanced starter motor continues using the typical pinion engagement mechanism with a starter solenoid that drives the pinion gear to engage or disengage the flywheel of the engine. When engaged, the starter motor can rotate the engine flywheel and, in turn, the crankshaft.

On the enhanced starter of a Stop/Start system the operation is done in two separate functions inside the solenoid, Starter Motor and Pinion Actuator. Each function controlled individually by the ECM. There are two separate relays to control the two separate parts of the enhanced solenoid:

- KR27 Starter Motor Relay
- KR27C Starter Pinion Actuator Relay

The two individually-controlled relays allow for smooth engagement of the pinion gear into the flywheel with minimum noise and wear.

When the vehicle is coming to a stop, just before the engine stops rotating (at approximately 50 RPM) during stop/start operation, the ECM energizes the Starter Pinion Solenoid Actuator Relay to easily push the pinion gear into the flywheel gear without gear clash. (Fig. 8) When the engine stops rotating during Stop/Start operation (Auto Stop mode), the starter pinion gear is fully engaged, ready for the starter motor to become energized to quickly start the engine again.

A secondary need for the starter pinion to be driven into the flywheel gear before the engine stops rotating is to address quickly changing demands on the engine. For example, when a driver is slowing nearly to a stop — and the Stop/Start system is preparing for Auto Stop mode — but suddenly decides to release the brake and accelerate

In this situation, the engine has already stopped rotating, or nearly so. A conventional starter cannot restart the engine until the engine has completely stopped. However, with the enhanced starter, the starter pinion gear is fully engaged and ready to begin rotating the engine even before it fully stops turning. Otherwise, the engine would actually have to stop rotating before the pinion can engage smoothly to begin a restart.

To prevent a lag in engine operation, the ECM uses predictive speed matching of the flywheel gear speed and the pinion gear speed to engage the pinion gear into the flywheel gear without gear clash before the engine fully stops. By predicting how long it takes the starter motor to spin up using an algorithm, the pinion gear speed can be matched to the flywheel gear speed. The result is an almost instant restart that is possible at extremely low engine speeds.

Circuit Description

Keyless Start

When the Ignition mode switch is placed in the crank position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the crank position. The BCM then sends a serial data message to the engine control module (ECM) that crank has been requested. The ECM then verifies that the clutch is fully depressed or the automatic transmission is in Park/Neutral. If it is, the ECM then supplies 12 V to the control circuit of the starter relay. When this occurs, battery positive voltage is supplied through the switch side of the crank relay to the S terminal of the starter solenoid.

Key Start

When the ignition switch is placed in the Start position, a discrete signal is supplied to the body control module (BCM) notifying it that the ignition is in the Start position. The BCM then sends a message to the engine control module (ECM) notifying it that CRANK has been requested. The ECM verifies that the transmission is in Park or Neutral. If it is, the ECM then supplies 12 V to the control circuit of the crank relay. When this occurs, battery positive voltage is supplied through the switch side of the crank relay to the S terminal of the starter solenoid.

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Section 6

HVAC

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Heating, Ventilation, and Air Conditioning

Description and Operation

Heating and Air Conditioning System Description and Operation

Engine Coolant

Engine coolant is the key element of the heating system. The engine thermostat controls the normal engine operating coolant temperature. Coolant pumped out of the engine enters the heater core through the inlet heater hose. The air flowing through the (Heating, Ventilation and Air Conditioning) HVAC module absorbs the heat of the coolant flowing through the heater core. The coolant then exits the heater core through the heater outlet hose and returns back to the engine block.

Auxiliary Electric Heater

Some Vehicles come with an auxiliary electric heater. This 12V electrically powered heating element is positioned directly behind the regular coolant flow based heater core in the HVAC case. All airflow goes through the regular heater core first, and then through the auxiliary electric heater. The auxiliary electric heater is active when the outside ambient temperature is below **8°C (46°F)** , the coolant temperature is below **75°C (167°F)** , and the temperature air mix door is near the full hot position.

A/C Cycle

Refrigerant is the key element in an air conditioning system. R-134a is presently the only approved refrigerant for this vehicle. R-134a is a very low temperature gas that can transfer the undesirable heat from the passenger compartment to the outside air.

The (Air Conditioning) A/C compressor is belt driven and operates when the magnetic clutch is engaged. The compressor builds pressure in the A/C system. Compressing the refrigerant also adds heat to the refrigerant. The refrigerant is discharged from the compressor through the discharge hose, and forced to flow to the condenser and then through the balance of the A/C system. The A/C system is mechanically protected with the use of a high pressure relief valve. If the high pressure A/C switch were to fail or if the refrigerant system becomes restricted and refrigerant pressure continued to rise, the high pressure relief will pop open and release refrigerant from the system.

Compressed refrigerant enters the condenser in a high temperature, high pressure vapor state. As the refrigerant flows through the condenser, the heat of the refrigerant is transferred to the ambient air passing through the condenser. Cooling the refrigerant causes the refrigerant to condense and change from a vapor to a liquid state.

The condenser is located in front of the radiator for maximum heat transfer. The condenser is made of aluminum tubing and aluminum cooling fins, which allows rapid heat transfer for the refrigerant. The semi-cooled liquid refrigerant exits the condenser and flows through the liquid line, to the (Thermal Expansion Valve) TXV.

The TXV is located at the evaporator inlet. The TXV is the dividing point for the high and the low pressure sides of the A/C system. As the refrigerant passes through the TXV, the refrigerant is lowered. Due to the pressure differential on the liquid refrigerant, the refrigerant will begin to boil at the TXV. The TXV also meters the amount of liquid refrigerant that can flow into the evaporator.

Refrigerant exiting the TXV flows into the evaporator core in a low pressure, liquid state. Ambient air is drawn through the HVAC module and passes through the evaporator core. Warm and moist air will cause the liquid refrigerant to boil inside the evaporator core.

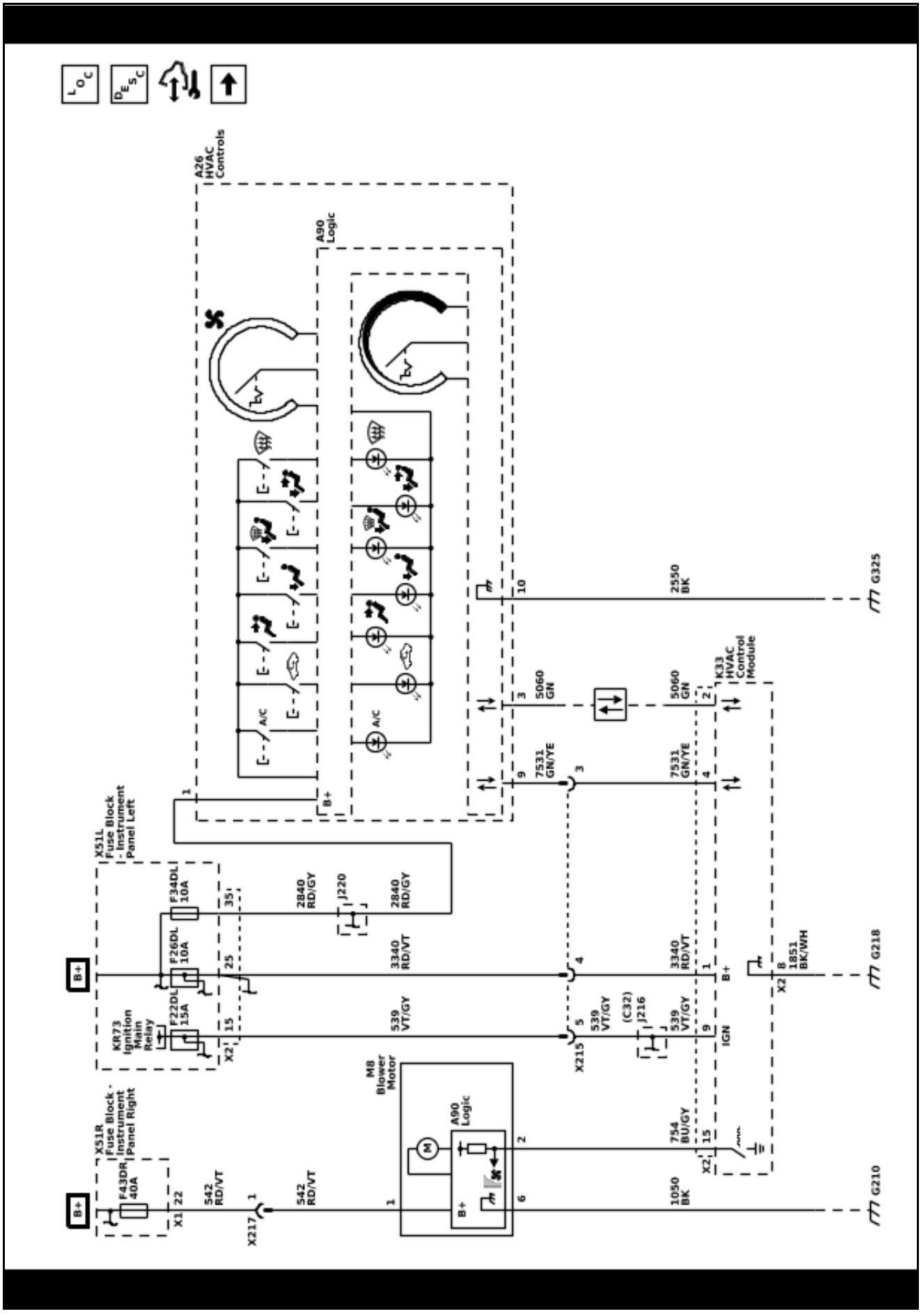
The boiling refrigerant absorbs heat from the ambient air and draws moisture onto the evaporator. The refrigerant exits the evaporator through the suction line and back to the compressor, in a vapor state. This completes the A/C cycle of heat removal. At the compressor, the refrigerant is compressed again and the cycle of heat removal is repeated.

The conditioned air is distributed through the HVAC module for passenger comfort. The moisture removed from the passenger compartment will also change form, or condense, and is discharged from the HVAC module as water.

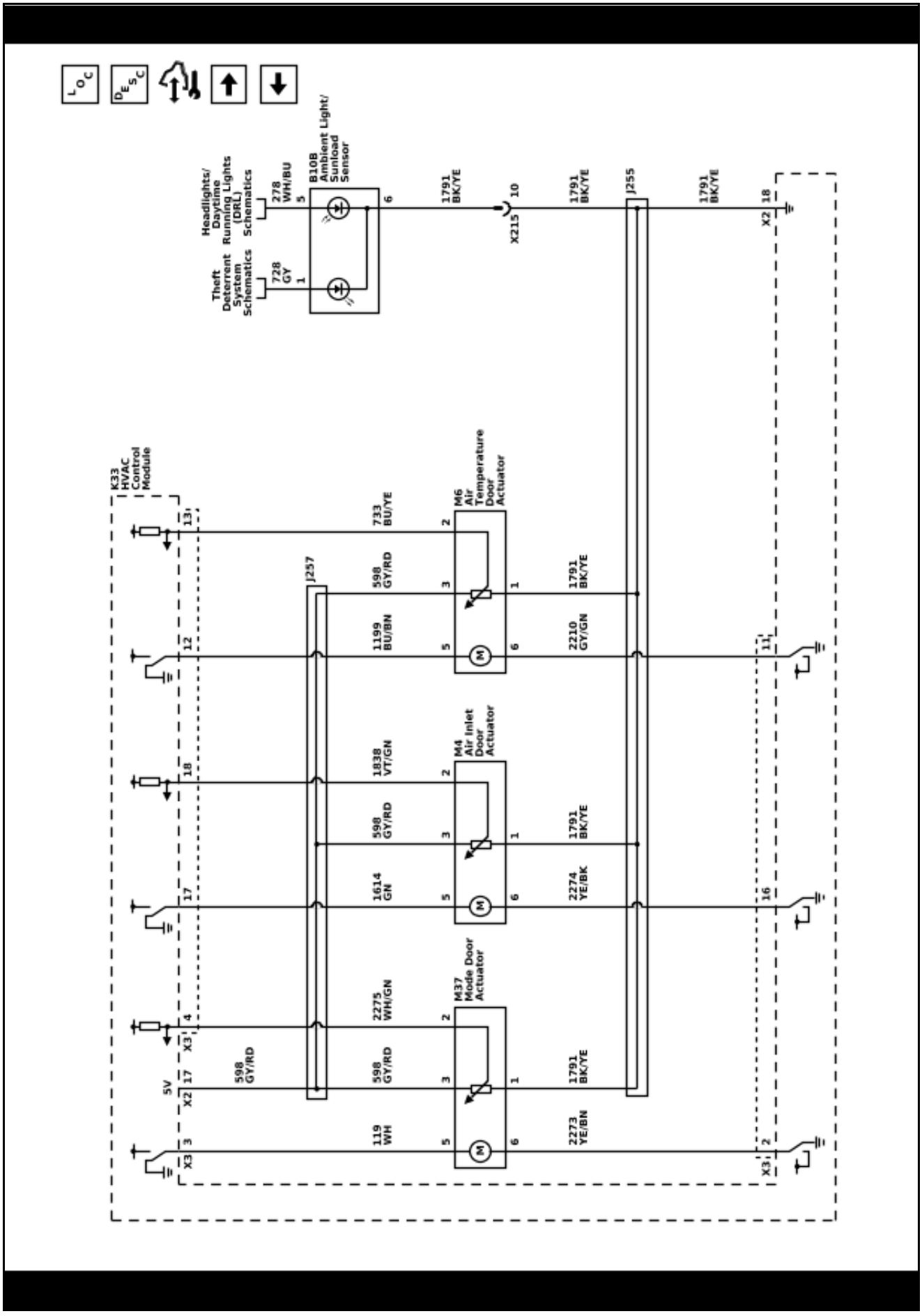
HVAC - Manual

Schematic and Routing Diagrams

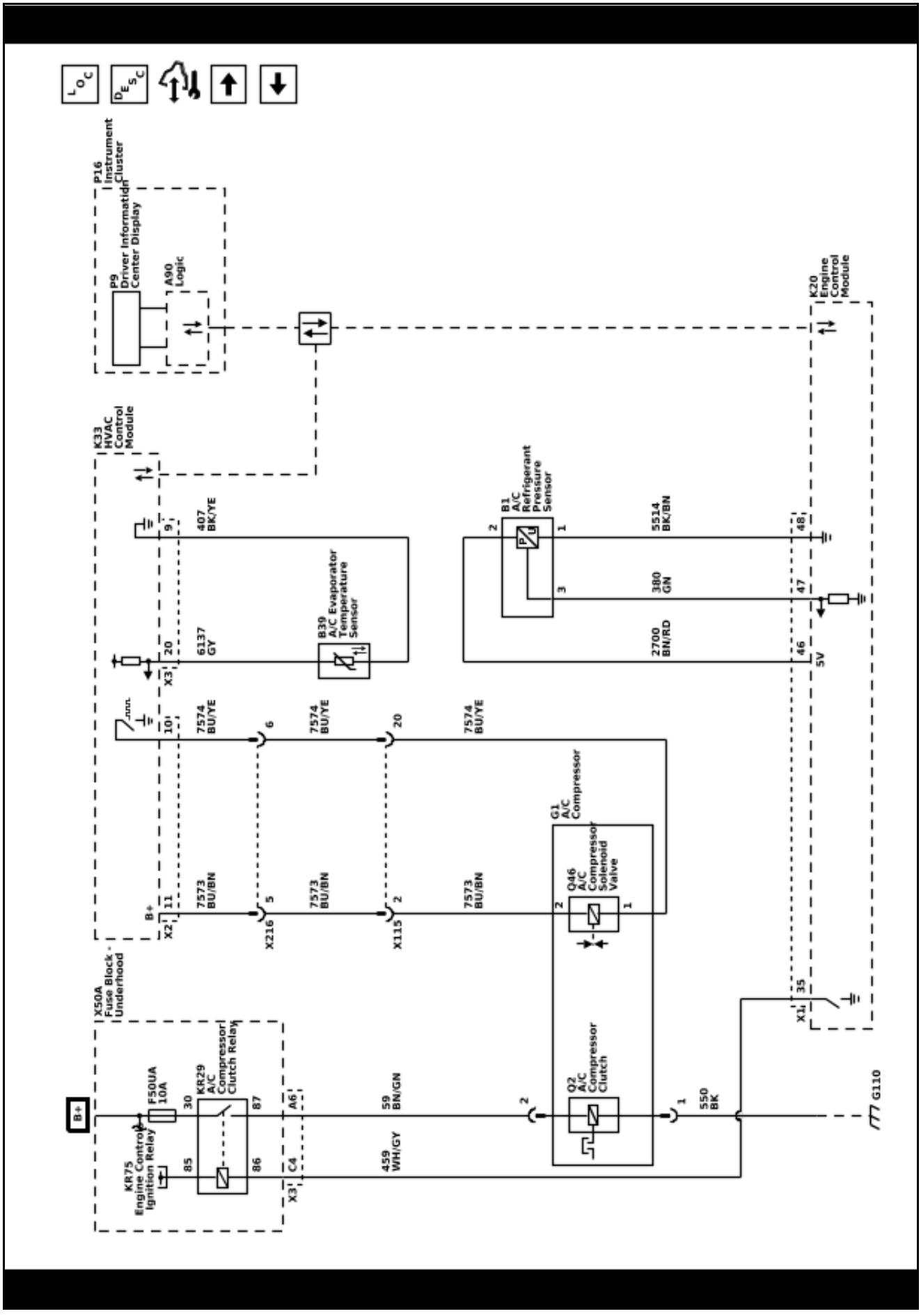
HVAC Schematics (Power, Ground, Serial Data and Controls)



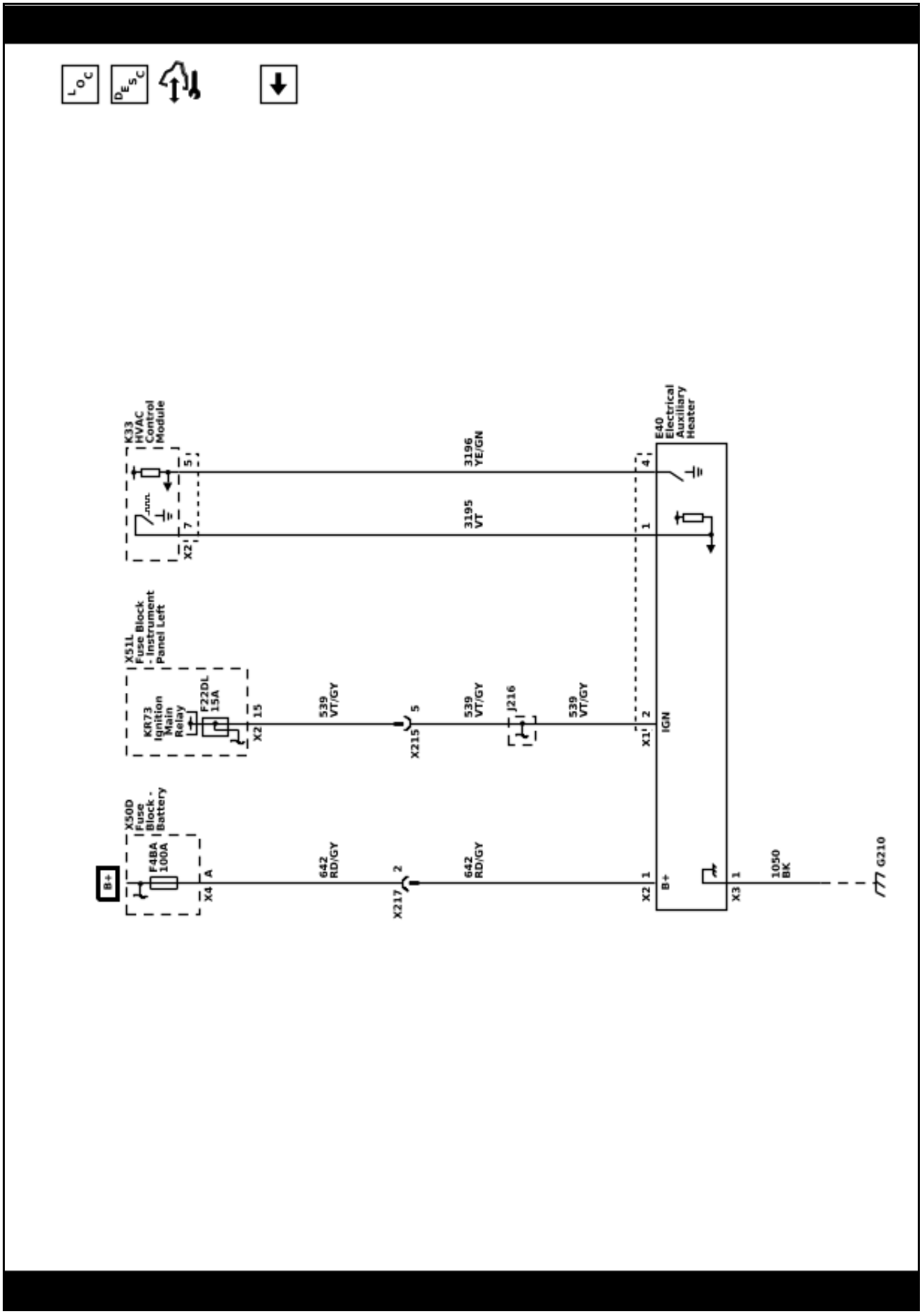
HVAC Schematics (Ambient Light/Sunload Sensor and Mode Doors)



HVAC Schematics (A/C Compressor Controls)



HVAC Schematics (Auxiliary Heater (C32))



Description and Operation

Manual HVAC Description and Operation

The air temperature and the air delivery description and operation are divided into eight areas:

- HVAC Control Components
- Air Speed
- Air Delivery
- Heating and A/C Operation
- Recirculation Operation
- Engine Coolant and A/C System Refrigerant

HVAC Control Components

HVAC Control

The HVAC control contains all switches, buttons, and dials which are required to control the functions of the HVAC system and serve as interface between the operator and the HVAC control module. The selected values are passed to the HVAC control module via LIN-Bus.

HVAC Control Module

The HVAC control module is a GMLAN device that interfaces between the operator and the HVAC system to maintain and control desired air temperature and air distribution settings. The battery positive voltage circuit provides power that the HVAC control module uses for keep alive memory. If the battery positive voltage circuit loses power, all HVAC DTCs and settings will be erased from keep alive memory. The body control module (BCM), which is the vehicle mode master, provides a device ON-Signal. The HVAC control module provides blower, air delivery mode and air temperature settings.

Actuators

Doors in the HVAC case assembly are used to control air flow. The HVAC control module operates the doors through the use of actuators, with one actuator being used for each door. The system has the following air control doors and associated actuators: mode, temperature, and recirculation.

Each actuator used in the system is a 5-wire bi-directional electric motor that incorporate a feedback potentiometer. The five circuits are, low reference, 5 V reference, actuator position signal, and two control circuits. The control circuits use either a ground or 12 V value to coordinate the actuator movement. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 V. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction.

When the actuator shaft rotates, the potentiometer's sliding contact changes the door position signal between 0–5 V. The HVAC control module converts the voltage signal to counts. The total range of the counts is 0–1024, with an operating range between 20–1000. The actual operating range of an actuator is determined during calibration. During calibration, the actuator is moved though its full range of travel and the module stores the minimum and maximum value. Based on the desired system operation, the module sets a commanded, or targeted, value for the actuators. The control circuits are operated to move the door to the required position, and the changing position signal is sent to the module. Once the actual position signal and the commanded value are the same, the module ceases operating the control circuits and the actuator (and door) remain in the desired position.

Blower Motor

The blower motor speed control signal from the HVAC Control Module, battery positive and ground circuits enable the blower motor to operate. The blower motor control circuitry is integrated within the blower motor assembly. The HVAC control module provides a low side pulse width modulation (PWM) signal to the blower motor to request a specific motor speed. The blower motor translates the PWM signal and drives the motor accordingly.

Evaporator Temperature Sensor

The evaporator temperature sensor is a 2-wire negative temperature coefficient thermistor. The sensor operates within a temperature range of −40 to +85°C (−40 to +185°F). The sensor is installed near the evaporator core to measure the air temperature exiting the core.

Based on vehicle operating conditions and operator settings, the HVAC software algorithms will determine a target evaporator air temperature. The operation of the compressor solenoid will be adjusted as needed to quickly reach and maintain the targeted temperature.

A/C Refrigerant Pressure Sensor

The A/C refrigerant pressure sensor is a 3-wire piezoelectric pressure transducer. A 5 V reference voltage, low reference, and signal circuits enable the sensor to operate. The A/C pressure signal can be between 0.2–4.8 V. When the A/C refrigerant pressure is low, the signal value is near 0 V. When the A/C refrigerant pressure is high, the signal value is near 5 V. The engine control module (ECM) converts the voltage signal to a pressure value. When pressure is too high or too low, the ECM will not allow the A/C compressor clutch to engage.

A/C Compressor

The A/C compressor uses a conventional belt driven magnetic clutch to engage and mechanically turn the compressor. When the A/C switch is pressed, the HVAC control module sends an A/C request message to the ECM via serial data. If specific criteria is met, the ECM then grounds the A/C compressor clutch relay control circuit, which will switch the A/C compressor clutch relay. With the relay contacts closed, battery voltage is supplied to the permanently grounded A/C compressor clutch. The A/C compressor clutch will then be activated.

This A/C system utilizes a variable displacement solenoid valve to alter the amount of displacement created by the turning of the compressor. The HVAC control module provides both battery voltage and a pulse width modulated ground to the variable displacement solenoid valve. When the A/C switch is pressed, the HVAC control module grounds the variable displacement solenoid using a (PWM) signal in

order to determine the amount of compressor displacement. The performance of the A/C compressor is regulated based on cooling load.

Air Speed

The blower control switch is part of the HVAC controls. The selected value of the blower switch position is sent to the HVAC control module via LIN-Bus. The blower motor control circuitry is integrated within the blower motor assembly. The HVAC control module provides a low side pulse width modulation (PWM) signal to the blower motor to request a specific motor speed. The blower motor translates the PWM signal and drives the motor accordingly.

Afterblow

Afterblow is a feature that dries the evaporator core by operating the blower motor after the engine is turned OFF under certain conditions. This reduces the amount of microbial growth that can create undesirable odors. For additional information on afterblow, the default setting, and changing the setting.

Air Delivery

The HVAC control module controls the distribution of air by the use of recirculation and mode door actuator. The modes that may be selected are:

- Defrost
- Defog
- Panel
- Floor

The desired air distribution mode can be selected with the air distribution switches at the HVAC control. The HVAC control delivers the values to the HVAC control module via LIN-Bus. The HVAC control module controls the mode door actuator so that it drives the door to the calculated position. Depending on the position of the door, air is distributed through various ducts leading to the outlets in the dash. Turning the mode door to the defrost position, the HVAC control module will move the recirculation actuator to outside air, reducing window fogging. When defrost is selected, the blower motor will be activated, regardless of the coolant temperature. The HVAC control module enables a high volume of air delivered to the front defrost vents. A/C is available in all modes.

The rear window defogger does not affect the HVAC system.

Heating and A/C Operation

The purpose of the heating and A/C system is to provide heated and cooled air to the interior of the vehicle. The A/C system will also remove humidity from the interior and reduce windshield fogging. Regardless of the temperature setting, the following can affect the rate that the HVAC system can achieve the desired temperature:

- Recirculation actuator setting
- Difference between inside and desired temperature
- Blower motor speed setting
- Mode setting

When the A/C switch is pressed, the HVAC controls sends a signal to the HVAC control module via LIN-Bus. The HVAC control module evaluates this signal and sends an A/C request signal to the ECM via CAN-Bus. The ECM checks all preconditions before releasing and if all conditions are met sends a release signal back to the HVAC control module. The ECM will provide a ground for the A/C compressor relay enabling it to close its internal contacts to send battery voltage to the A/C compressor clutch coil. The A/C compressor clutch will be activated. The performance of the A/C compressor is regulated via a variable A/C compressor solenoid valve. The HVAC control module supplies battery voltage to the A/C compressor. When the A/C switch is pressed, the HVAC control module provides a pulse width modulation (PWM) signal to the A/C compressor solenoid valve in order to command the performance of the A/C compressor.

The following conditions must be met in order to activate the A/C compressor:

- Battery voltage is between 9–18 V
- Engine coolant temperature is less than 124°C (255°F)
- Engine speed is greater than 600 RPM
- Engine speed is less than 5 500 RPM
- A/C high side pressure is between 269–2 929 kPa (39–425 PSI)
- Throttle position is less than 100%
- Evaporator temperature is greater than 3°C (38°F)
- ECM does not detect immoderate torque load
- ECM does not detect insufficient idle quality
- The ambient temperature is above 1°C (34°F)

The sensor information is used by the ECM to determine the following:

- The A/C high side pressure
- An A/C system load on the engine
- An immoderate A/C high side pressure
- The heat load at the A/C condenser

The air streams into the passenger compartment through the heater core and the evaporator core. The air temperature actuator drives the mixed air door to direct the airflow. If the interior temperature should be increased, the mixed air door is put into the position in which more air streams through the heater core. If the interior temperature should be decreased, the mixed air door is put into the position in which more air streams through the evaporator core.

Recirculation Operation

The recirculation switch is integrated into the HVAC control. The selected recirculation setting is sent to the HVAC control module via LIN-Bus. The HVAC control module controls the air intake using the recirculation actuator. In recirculation mode the recirculation door is positioned to block outside air from entering and circulate the air within the vehicle. In outside air mode the recirculation door is positioned to route outside air into the vehicle.

Recirculation is only available if the defrost mode is not active. When the defrost mode is active, the recirculation actuator positions the recirculation door so that outside air is circulated to the windshield to reduce fogging.

Electric Auxiliary Heater (C32)

Some models are equipped with an auxiliary electric heater to assist in warming the passenger compartment when the engine coolant has not sufficiently warmed to operating temperature. The heater is a 12 V positive temperature coefficient heating element located in the HVAC case just downstream of the traditional heater core. The HVAC control module will activate it when the outside temperature is less than approximately 8°C (46°F), the engine coolant temperature is less than approximately 75°C (167°F), and the temperature blend door is commanded to the full hot position.

Engine Coolant and A/C System Refrigerant

For information on engine coolant, coolant flow, A/C refrigerant, and the A/C refrigerant cycle, refer to *Heating and Air Conditioning System Description and Operation on page 6-3*.

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Section 7

Power and Signal Distribution

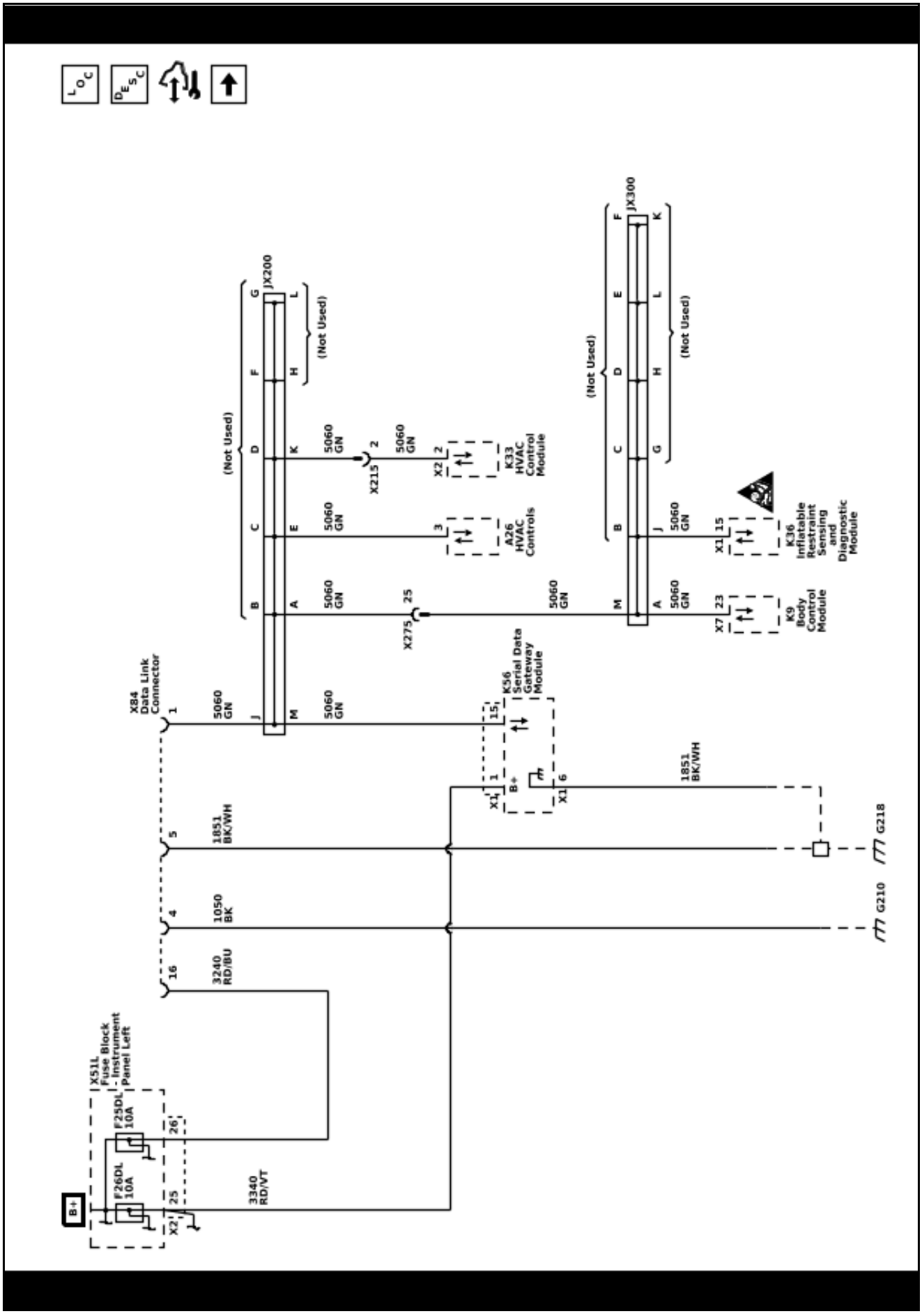
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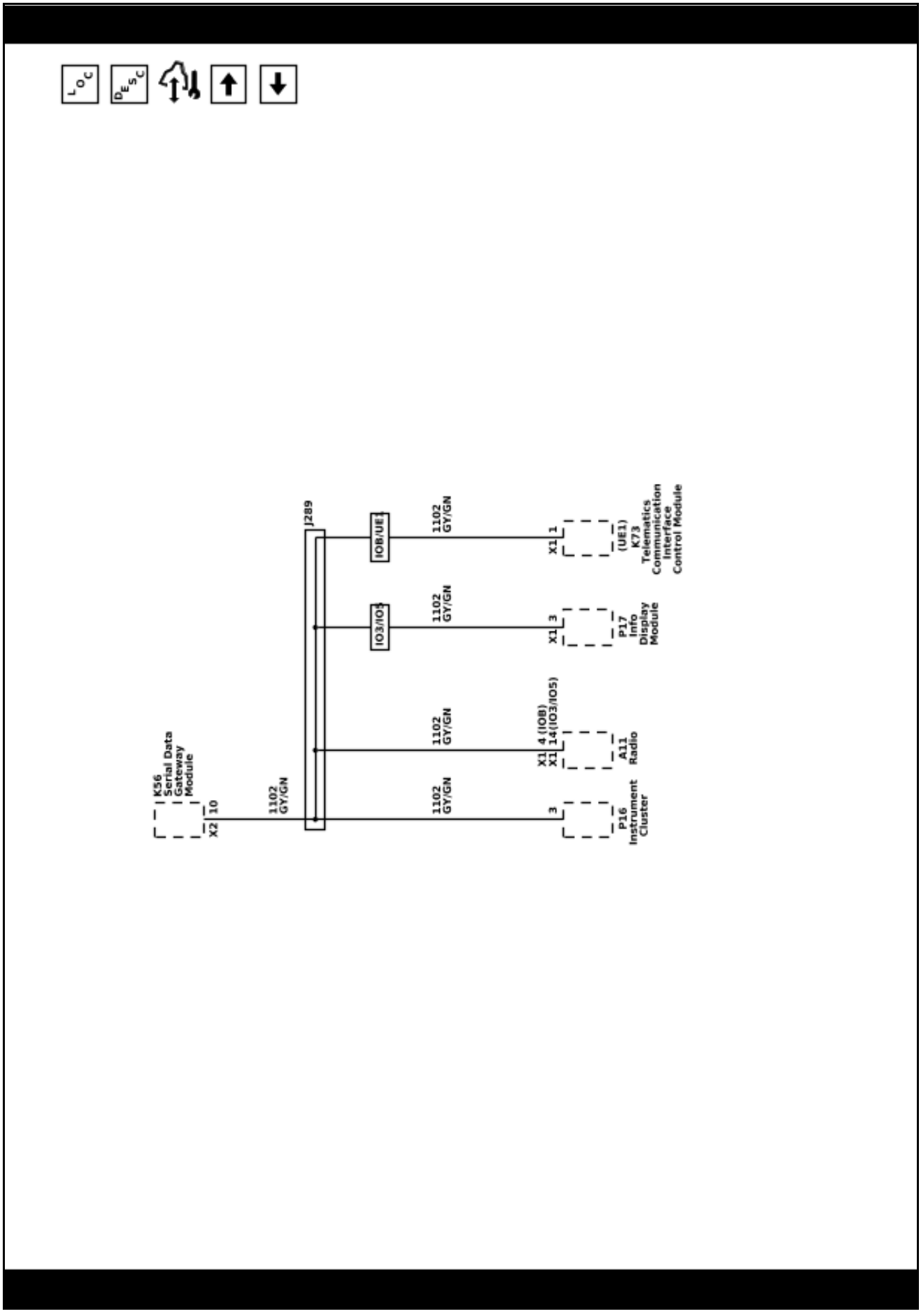
Data Communications

Schematic and Routing Diagrams

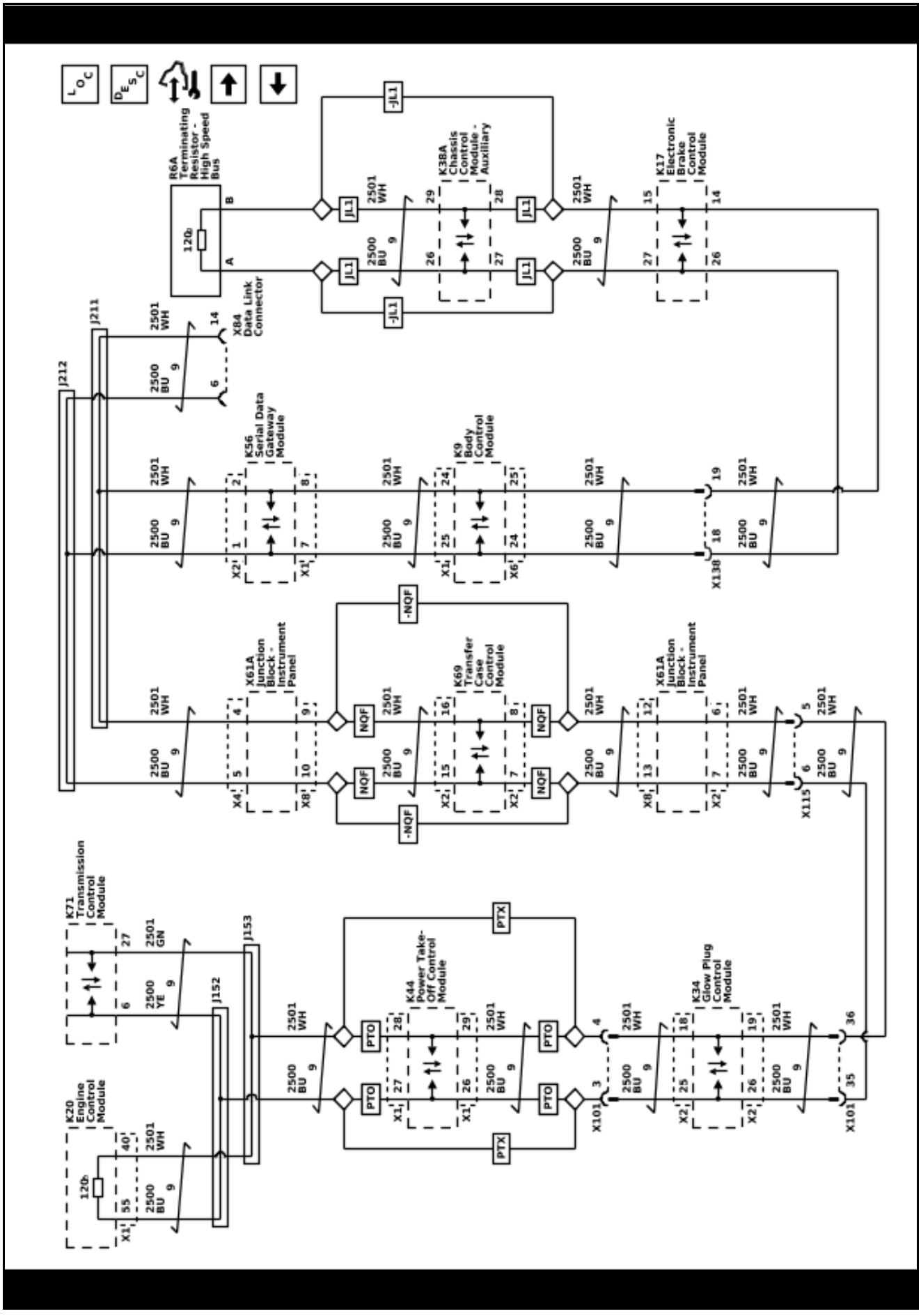
Data Communication Schematics (Data Link Power and Ground, and Low Speed GMLAN)



Data Communication Schematics (Gateway Isolated Low Speed GMLAN)

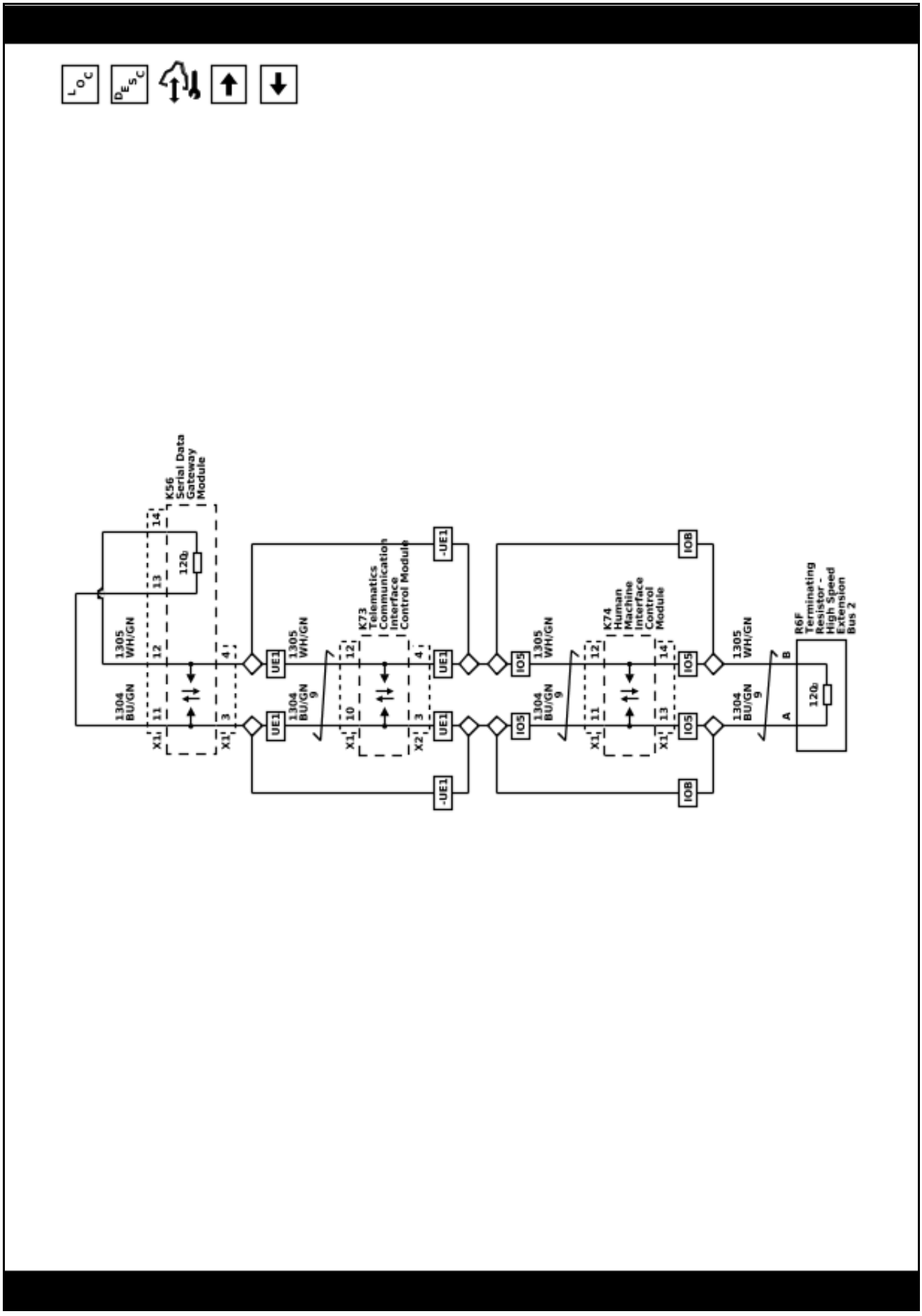


Data Communication Schematics (High Speed GMLAN)

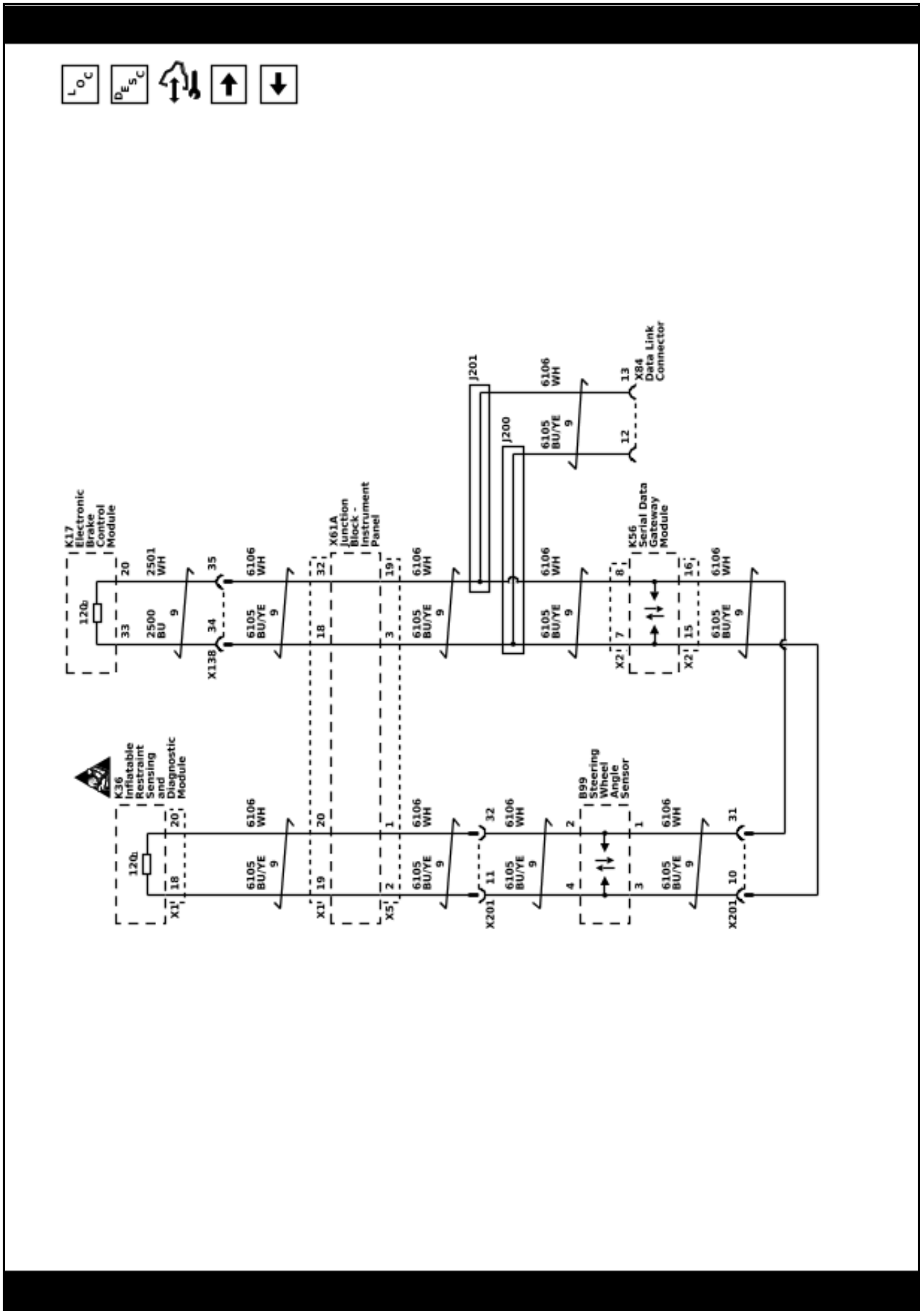


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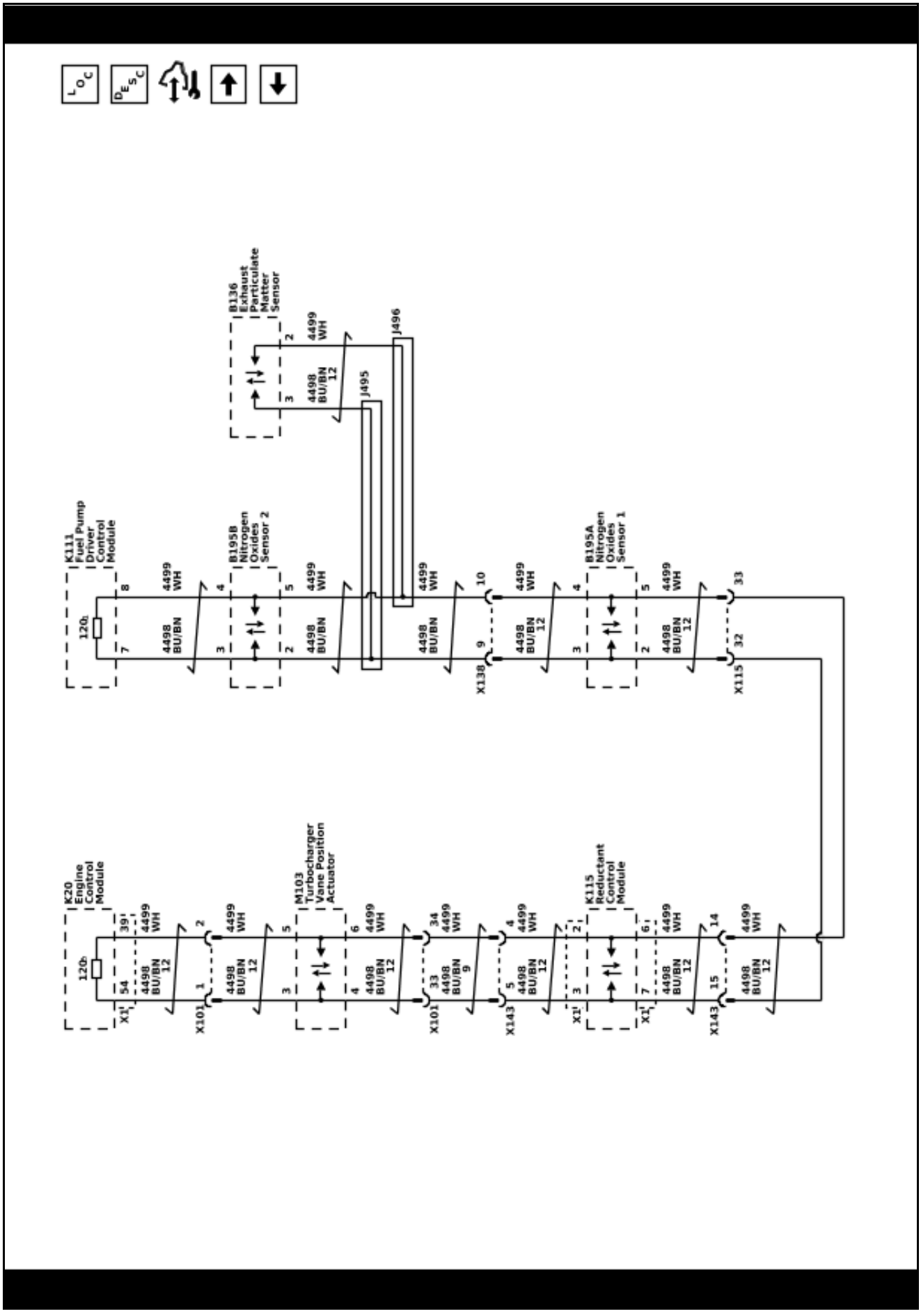
Data Communication Schematics (Gateway Isolated High Speed GMLAN (IO5/UE1))



Data Communication Schematics (Chassis Expansion Bus)



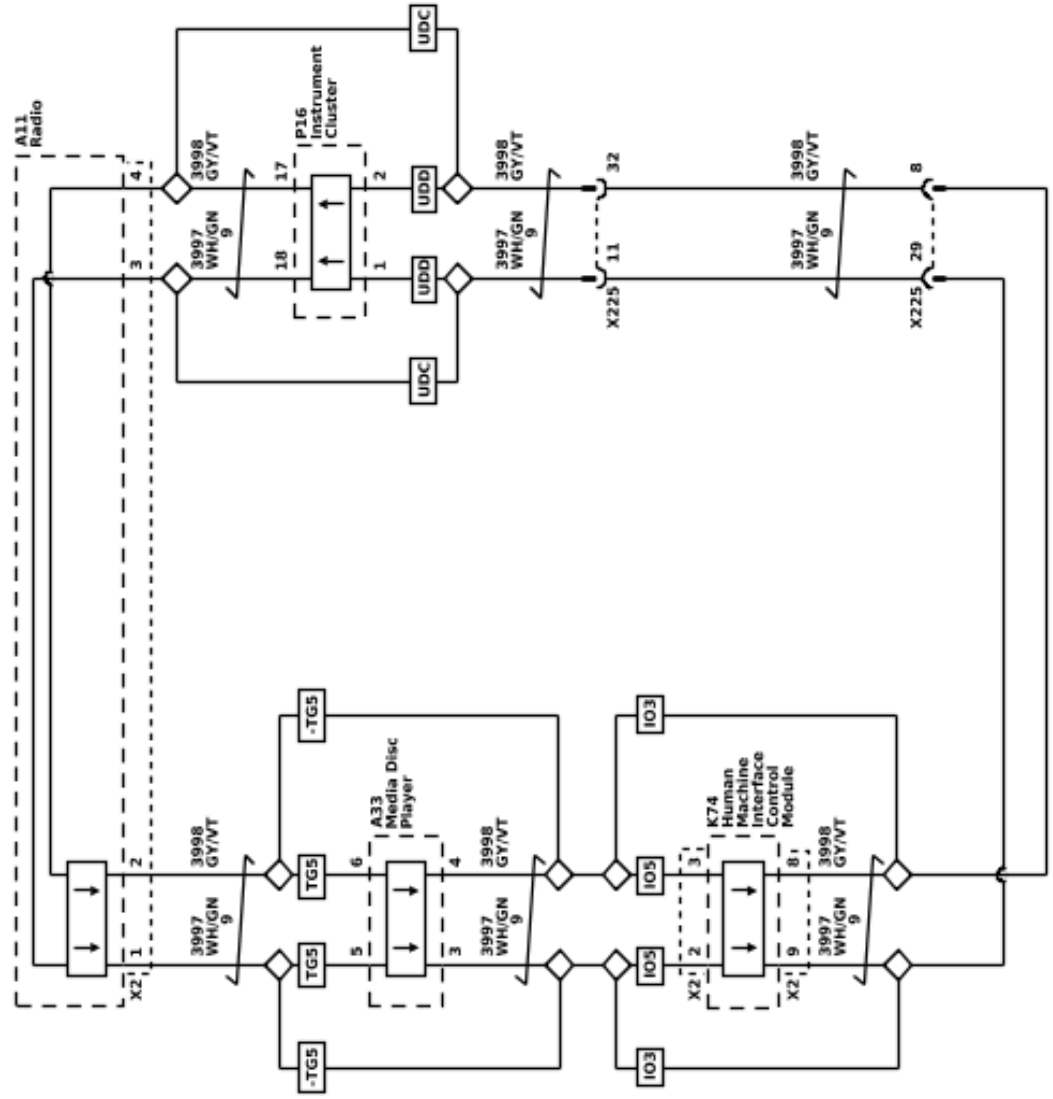
Data Communication Schematics (Powertrain Expansion Bus)



Data Communication Schematics (CAN Data (91B/91C/91D/91E))

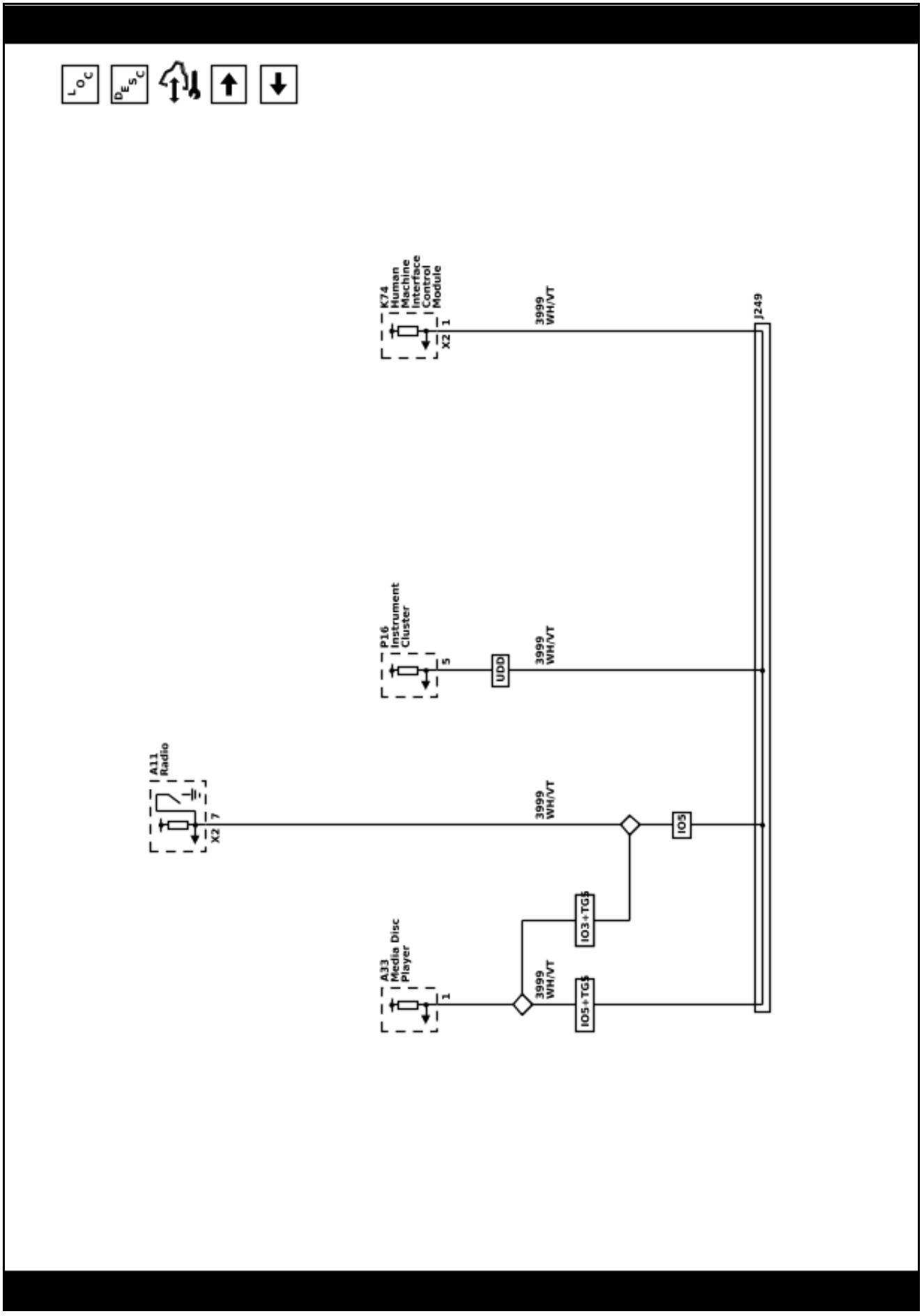
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Data Communication Schematics (MOST Communication Bus (IO3/IO5))

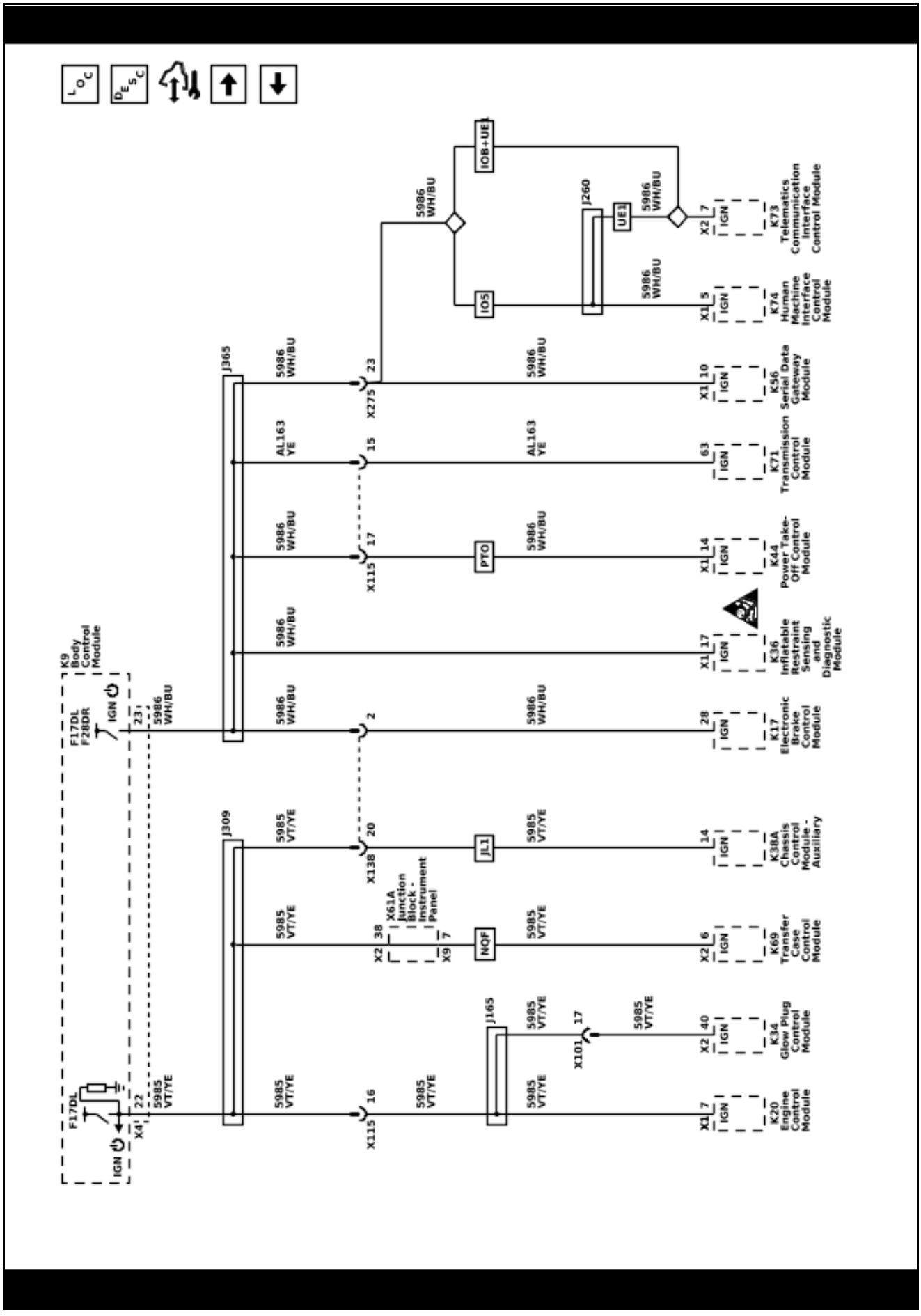


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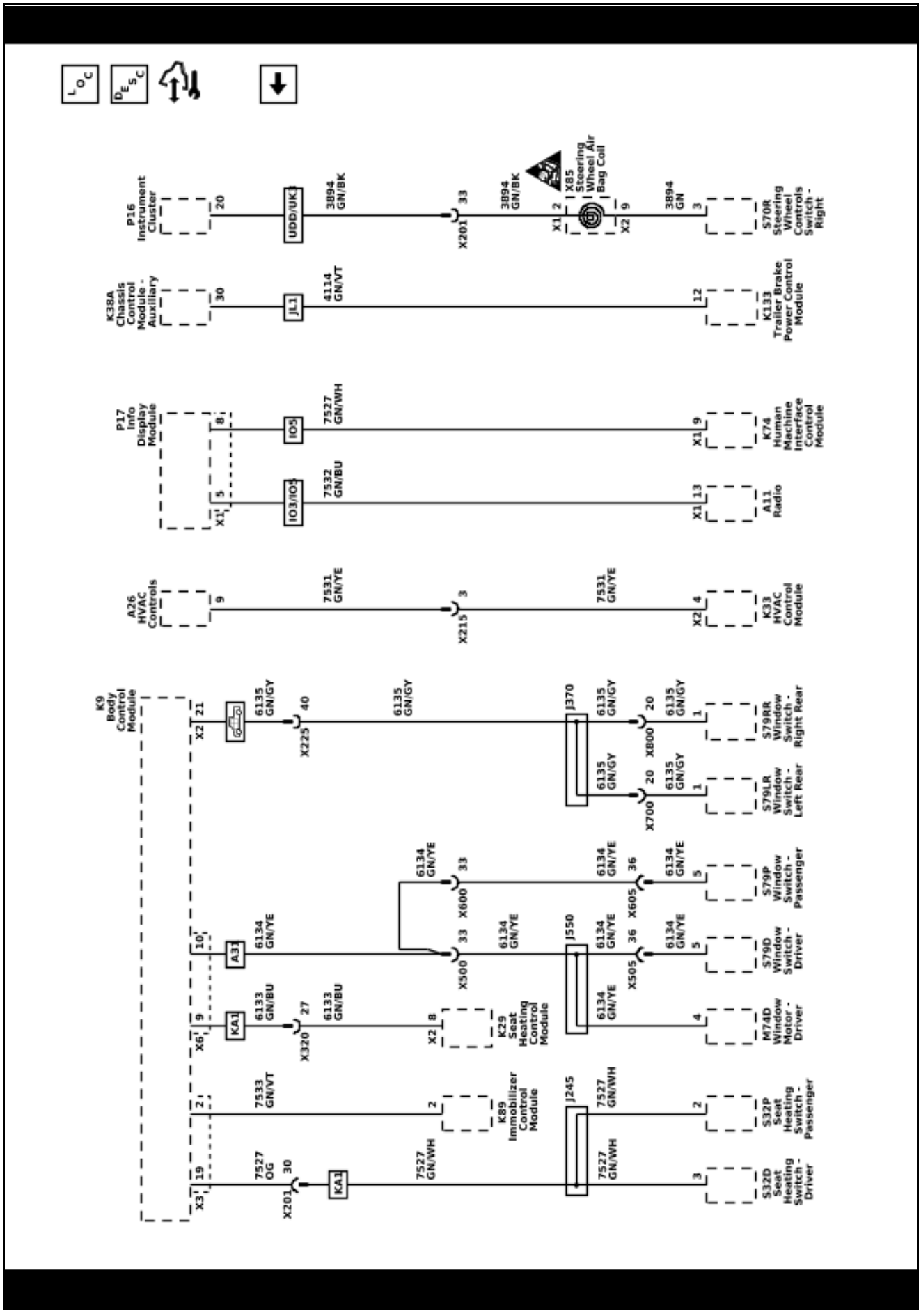
Data Communication Schematics (MOST Communication Enable (IO3/IO5))



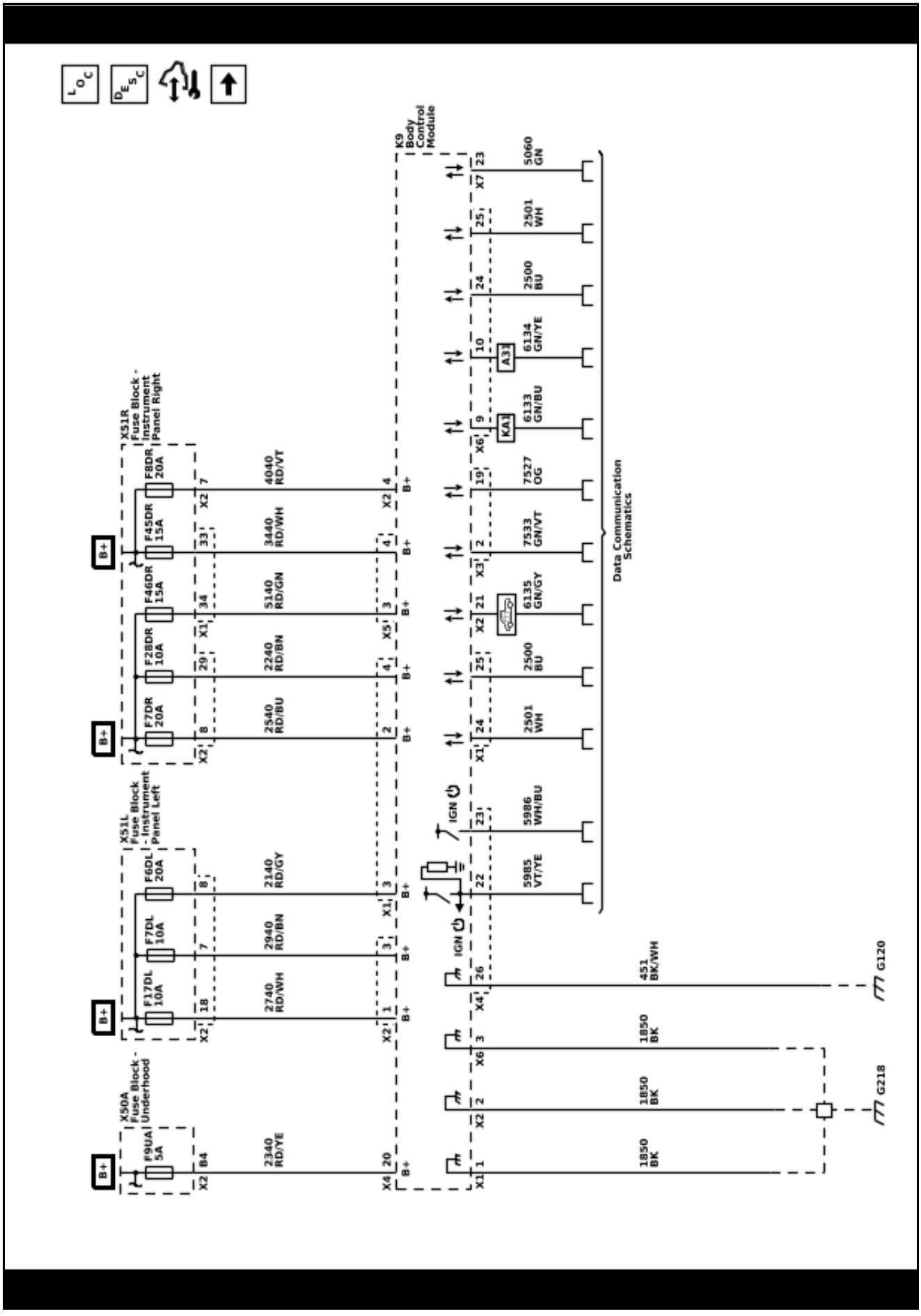
Data Communication Schematics (Accessory Wakeup and Communications Enable)



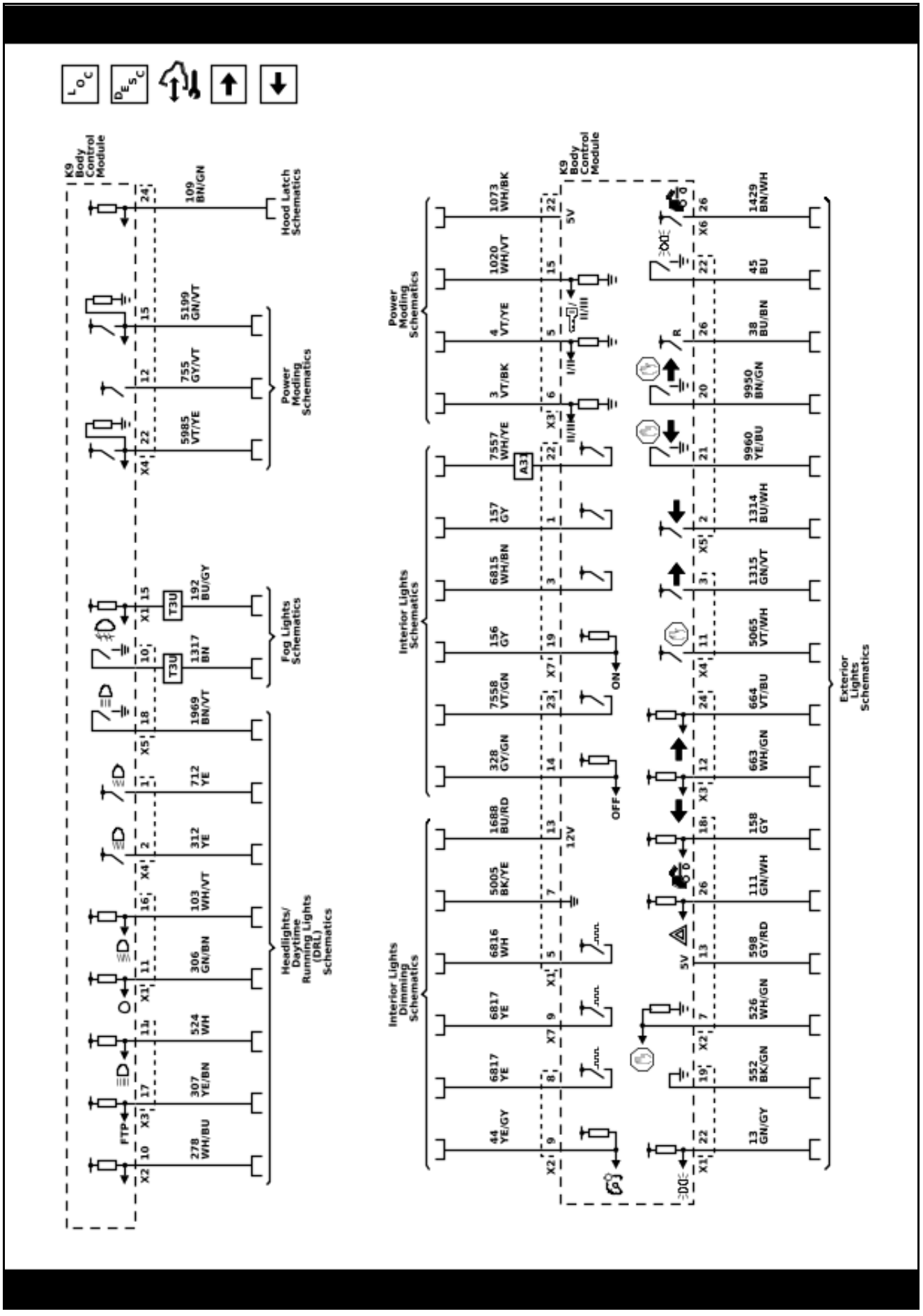
Data Communication Schematics (Local Interconnect Network)



Body Control System Schematics (Module Power, Ground and Serial Data)

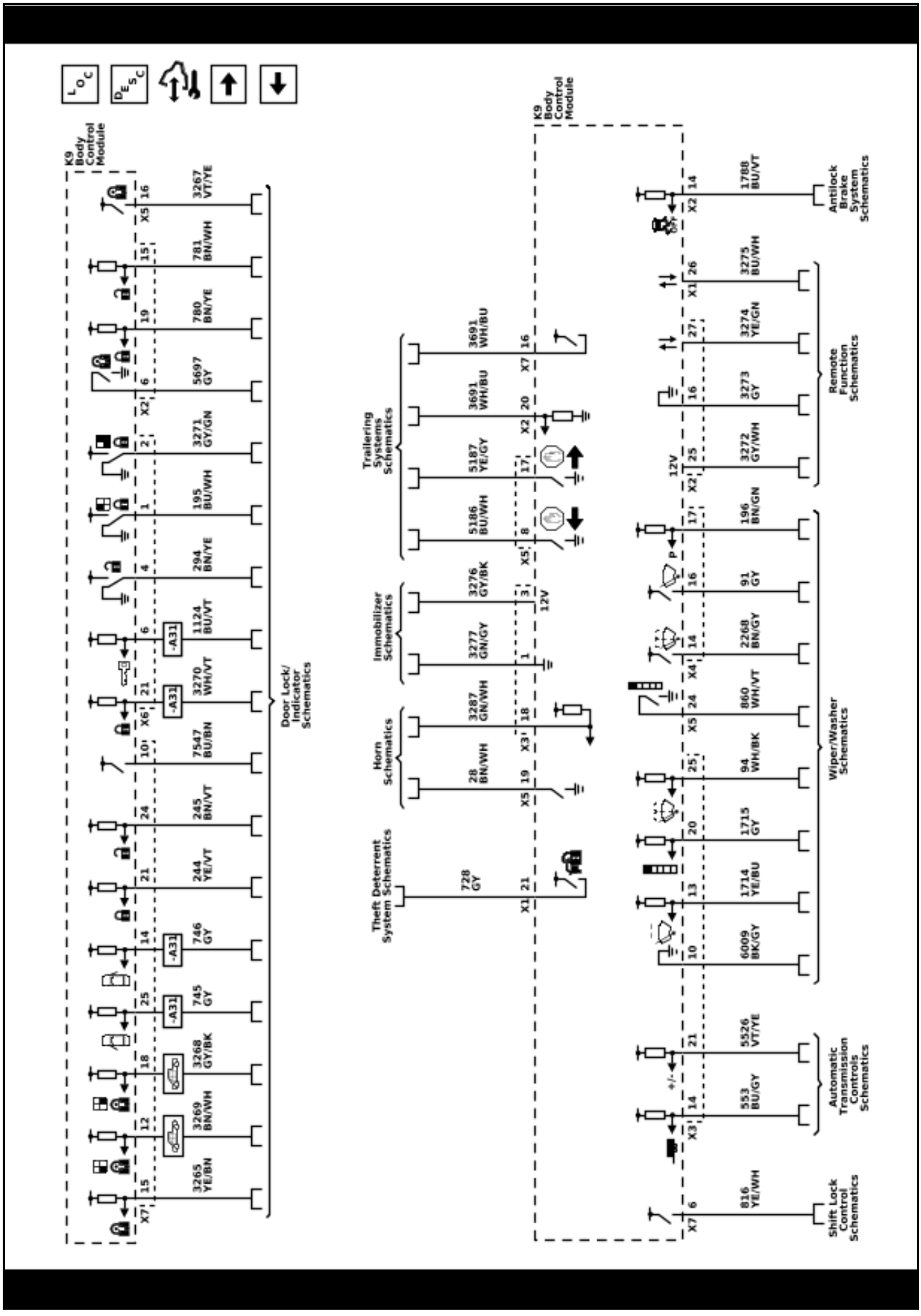


Body Control System Schematics (Subsystem References (1 of 3))

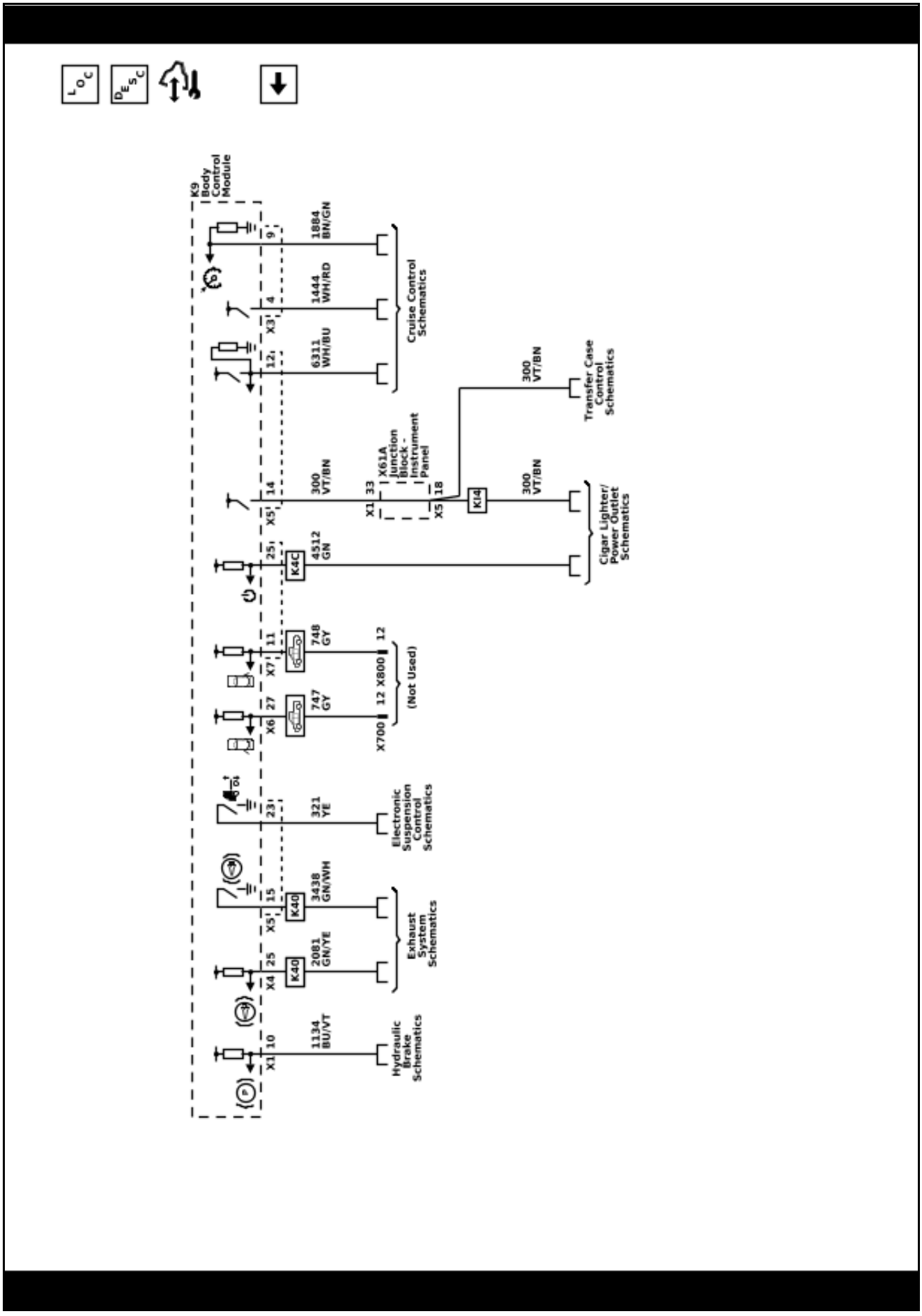


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Body Control System Schematics (Subsystem References (2 of 3))



Body Control System Schematics (Subsystem References (3 of 3))



Description and Operation

Body Control System Description and Operation

The body control system consists of the body control module (BCM), communications, and various input and outputs. Some inputs, outputs and messages require other modules to interact with the BCM. The BCM also has discrete input and output terminals to control the vehicle's body functions. The BCM is wired to the high speed GMLAN serial data bus, low speed GMLAN serial data bus and Multiple LIN buses and acts as a gateway between them.

Power Mode Master

This vehicle body control module (BCM) functions as the power mode master (PMM). The ignition switch is a low current switch with multiple discrete ignition switch signals to the PMM for determining the power mode that will be sent over the serial data circuits to the other modules that need this information; the PMM will activate relays and other direct outputs of the PMM as needed. Refer to *Power Mode Description and Operation on page 7-253* for a complete description of power mode functions.

Gateway

The body control module (BCM) in this vehicle functions as a gateway or translator. The purpose of the gateway is to translate serial data messages between the GMLAN high speed bus and the GMLAN low speed bus for communication between the various modules. The gateway will interact with each network according to that network's transmission protocol.

All communication between the BCM and a scan tool is on the high speed GMLAN serial data circuits. A lost communication DTC typically is set in modules other than the module with a communication failure.

Body Control

The various body control module (BCM) input and output circuits are illustrated in the corresponding functional areas on the BCM electrical schematics. Refer to the *Body Control System Schematics on page 7-15* for more detailed information.

Data Link Communications Description and Operation

Note: This is an overview of different serial data buses used by GM devices to communicate with each others. Use *Data Communication Schematics on page 7-4* to find out which serial data buses are configured for a specific vehicle.

Circuit Description

There are many components in a vehicle that rely on information from other sources, transmit information to other sources, or both. Serial data communication networks provide a reliable, cost effective, way for various components of the vehicle to “talk” to one another and share information.

GM uses a number of different communication buses to insure the timely and efficient exchange of information between devices. When compared to each other, some of these buses are different in nature as far as speed, signal characteristics, and behavior. An example of this is the High Speed GMLAN and Low Speed GMLAN buses.

On the other hand, when other buses are compared to each other they have similar characteristics and simply operate in parallel. In this case they are used to group together components which have high interaction. Examples are the High Speed GMLAN, Powertrain Expansion, and Chassis Expansion buses. This allows them to communicate with each other on a bus with reduced message congestion insuring faster and the more timely exchange of information than if all vehicle devices were on a single bus.

The majority of information that exists within a given network generally stays local; however some information will have to be shared on other networks. Control modules designated as Gateway’s perform the function of transferring information between the various buses. A Gateway module is connected to at least 2 buses and will interact with each network according to its message strategy and transmission models.

GMLAN provides the capability for a receiving device to monitor message transmissions from other devices in order to determine if messages of interest are not being received. The primary purpose is to allow reasonable default values to be substituted for the information no longer being received. Additionally, a device may set a Diagnostic Trouble Code to indicate that the device it is expecting information from is no longer communicating.

High Speed GMLAN Circuit Description

A High Speed GMLAN Bus is used where data needs to be exchanged at a high enough rate to minimize the delay between the occurrence of a change in sensor value and the reception of this information by a control device using the information to adjust vehicle system performance.

The High Speed GMLAN serial data network consists of two twisted wires. One signal circuit is identified as GMLAN-High and the other signal circuit is identified as GMLAN-Low. At each end of the data bus there is a 120 Ω termination resistor between the GMLAN-High and GMLAN-Low circuits.

Data symbols (1’s and 0’s) are transmitted sequentially at a rate of 500 Kbit/s. The data to be transmitted over the bus is represented by the voltage difference between the GMLAN-High signal voltage and the GMLAN-Low signal voltage.

When the two wire bus is at rest the GMLAN-High and GMLAN-Low signal circuits are not being driven and this represents a logic “1”. In this state both signal circuits are at the same voltage of 2.5 V. The differential voltage is approximately 0 V.

When a logic “0” is to be transmitted, the GMLAN-High signal circuit is driven higher to about 3.5 V and the GMLAN-Low circuit is driven lower to about 1.5 V. The differential voltage becomes approximately 2.0 (+/- 0.5) V.

Chassis High Speed GMLAN Circuit Description

The GMLAN Chassis Expansion Bus is basically a copy of the High Speed GMLAN Bus except that its use is reserved for chassis components. This implementation splits message congestion between two parallel buses helping to insure timely message transmission and reception. Sometimes communication is required between the Chassis Expansion Bus and the primary High Speed GMLAN Bus. This is accomplished by using the K17 Electronic Brake Control Module (EBCM) as the Gateway module. Since the High Speed GMLAN Chassis Expansion Bus and primary High Speed GMLAN Bus operate in the same manner, the diagnostics for each are similar.

Powertrain High Speed GMLAN Circuit Description

The GMLAN Powertrain Expansion Bus is basically a copy of the High Speed GMLAN Bus except that its use is reserved for Powertrain components. The bus is optional based upon feature content. Sometimes communication is required between the Powertrain Expansion Bus and the primary High Speed GMLAN Bus. This is accomplished by using the K20 Engine Control Module (ECM) as the Gateway module. Since the High Speed GMLAN Powertrain Expansion Bus and the primary High Speed GMLAN Bus operate in the same manner, the diagnostics for each are similar.

Media Oriented Systems Transport (MOST) Circuit Description

The MOST Infotainment network is a dedicated high speed multimedia streaming data bus independent from GMLAN. The MOST bus will be configured in a physical hardwired loop with each device within the bus sends and receives data on an assigned MOST addresses in a set order. Each device on the MOST bus will be required to have twisted pair copper wires (2 transmit TX, 2 receive RX, and 1 electronic control line which is a 12 V wakeup signal line). The A11 Radio is the MOST Master and will monitor the bus for vehicle configuration, Infotainment data messages and errors on the bus. The MOST initialization consists of a short 100 ms low voltage pulse on the electronic control line (or MOST control line) connected to all devices contained on the MOST ring. This wakeup message once received by each device, will first respond with a generic device response. Once these initial responses on the MOST bus are reported successfully without error to the A11 Radio, the second data request will record the MOST device addresses, their functionality requirements and capabilities within. The A11 Radio will learn this information and also record the address node sequence on the MOST bus at this point. This node address list will now be stored within the A11 Radio as the MOST bus configuration (called “Last Working MOST ID of Node 1 – 9” on scan tool data display).

When MOST receive, transmit, or control line faults are detected, transmit/receive messages will not received as expected from the wakeup request. The A11 Radio and the K74 Human Machine Interface Control Module will then perform diagnostics to isolate these MOST faults. If the MOST control line is shorted low to 0 V for excess amount of time, the A11 Radio will set a U2098 DTC and K74 Human Machine Interface Control Module will set a U0029 02 DTC. At this point the MOST bus will be unable to communicate until the shorted MOST control line is repaired.

Once the shorted MOST control line diagnostics pass, the A11 Radio will attempt to resend the initial short pulse attempts up to 3 times on the MOST control line. If the expected responses are not received, the A11 Radio continues into a failure mode setting a U0028 DTC and will continue on to send one 300 ms long pulse, which will enable the furthest upstream transmitting device to become the surrogate MOST Master in this MOST fault/diagnostic mode. When the A11 Radio receives this new MOST Master identity, the surrogate MOST master device can be identified based on scan tool data parameter “Surrogate MOST Master Node Upstream Position”. The scan tool should be used to determine the MOST bus configuration and direction by utilizing the “Last Working MOST ID of Node 1 – 9” parameters from the A11 Radio data display. When a fault is present, it will indicate the newly enabled “Surrogate MOST Master Node Upstream Position” from the A11 Radio. This will assist in determining where the MOST bus/control is at fault. The MOST device upstream from the surrogate MOST master device, transmit, receive, or control lines will be the suspect areas for diagnostics at this point. These faults can be associated with any of the MOST transmit, receive, or control line twisted copper wires or possibly an internal device fault.

The K74 Human Machine Interface Control Module will set a U0029 00 DTC when it diagnoses a MOST bus not communicating properly after one attempt. When the DTC U0029 00 is set by the K74 Human Machine Interface Control Module without the corresponding DTC U0028 from the A11 Radio, it will be an indication of an intermittent wiring/device condition.

Low Speed GMLAN Circuit Description

Low Speed GMLAN Bus is used in applications where a high data rate is not required which allows for the use of less complex components. It is typically used for operator controlled functions where the response time requirements are slower than those required for dynamic vehicle control.

The Low Speed GMLAN Serial Data Network consists of a single wire, ground referenced bus with high side voltage drive. During on road vehicle operation data symbols (1’s and 0’s) are transmitted sequentially at the normal rate of 33.3 Kbit/s. For component programming only, a special high speed data mode of 83.3 Kbit/s may be used.

Unlike the high speed dual wire networks, the single wire low speed network does not use terminating resistors at either end of the network.

The data symbols to be transmitted over the bus are represented by different voltage signals on the bus. When the Low Speed GMLAN Bus is at rest and is not being driven, there is a low signal voltage of approximately 0.2 V. This represents a logic “1”. When a logic “0” is to be transmitted, the signal voltage is driven higher to around 4.0 V or higher.

Local Interconnect Network (LIN) Circuit Description

The Local Interconnect Network (LIN) Bus consists of a single wire with a transmission rate of 10.417 Kbit/s. This bus is used to exchange information between a master control module and other smart devices which provide supporting functionality. This type of configuration does not require the capacity or speed of either a High Speed GMLAN Bus or Low Speed GMLAN Bus and is thus relatively simpler.

The data symbols (1's and 0's) to be transmitted are represented by different voltage levels on the communication bus. When the LIN Bus is at rest and is not being driven, the signal is in a high voltage state of approximately Vbatt. This represents a logic "1". When a logic "0" is to be transmitted, the signal voltage is driven low to about ground (0.0 V).

Communication Enable Circuit Description

Devices on High Speed GMLAN Bus enable or disable communication based on the voltage level of the communication enable circuit. When the circuit voltage is high (around 12 V), communications are enabled. When the circuit is low, communications are disabled.

Data Link Connector (DLC)

The X84 Data Link Connector (DLC) is a standardized 16-cavity connector. Connector design and location is dictated by an industry wide standard, and is required to provide the following:

- Terminal 1 Low speed GMLAN communications terminal
- Terminal 4 Scan tool power ground terminal
- Terminal 5 Common signal ground terminal
- Terminal 6 High speed GMLAN serial data bus (+) terminal
- Terminal 12 Chassis high speed GMLAN serial bus (+) terminal
- Terminal 13 Chassis high speed GMLAN serial bus (-) terminal
- Terminal 14 High speed GMLAN serial data bus (-) terminal
- Terminal 16 Scan tool power, battery positive voltage terminal

Serial Data Reference

The scan tool communicates over the various buses on the vehicle. When a scan tool is installed on a vehicle, the scan tool will try to communicate with every device that could be optioned into the vehicle. If an option is not installed on the vehicle, the scan tool will display No Comm (or Not Connected) for that optional device. In order to avert misdiagnoses of No Communication with a specific device, refer to Data Link References for a list of devices and the buses they communicate with. Use schematics and specific vehicle build RPO codes to determine optional devices.

Serial Data Gateway Module Description and Operation

The K56 Serial Data Gateway Module is used to handle communications between multiple GMLAN busses and functions as a gateway to isolate the secure networks from the unsecured networks. It was created to mitigate bus loading to support cyber security and new active/advanced safety features like Limited Ability Autonomous Driving and Enhanced Collision Avoidance (if equipped). The K56 Serial Data Gateway Module is used as a frame-to-frame gateway for all functional messages.

Depending on the vehicle contents, the K56 Serial Data Gateway Module is gating between primary High Speed GMLAN Bus, Gateway Expansion High Speed GMLAN Bus, Gateway Isolated High Speed GMLAN Bus, and Chassis High Speed GMLAN Bus. The K56 Serial Data Gateway Module is also gating between primary Low Speed GMLAN Bus and Gateway Isolated Low Speed GMLAN Bus.

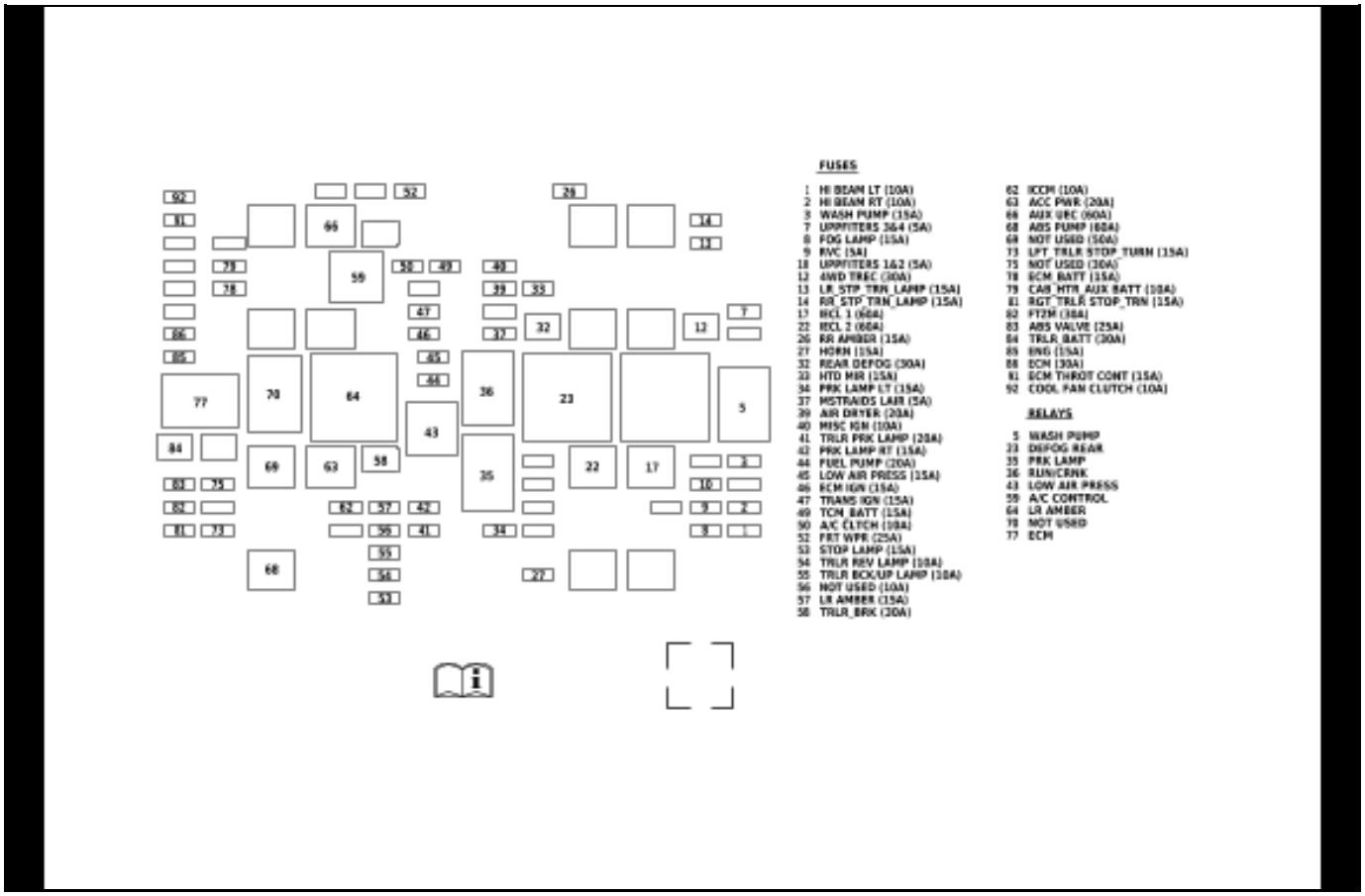
Communication between the K56 Serial Data Gateway Module and a scan tool is done through the primary High Speed GMLAN Bus.

Electrical Component and Inline Harness Connector End Views

Component Locator

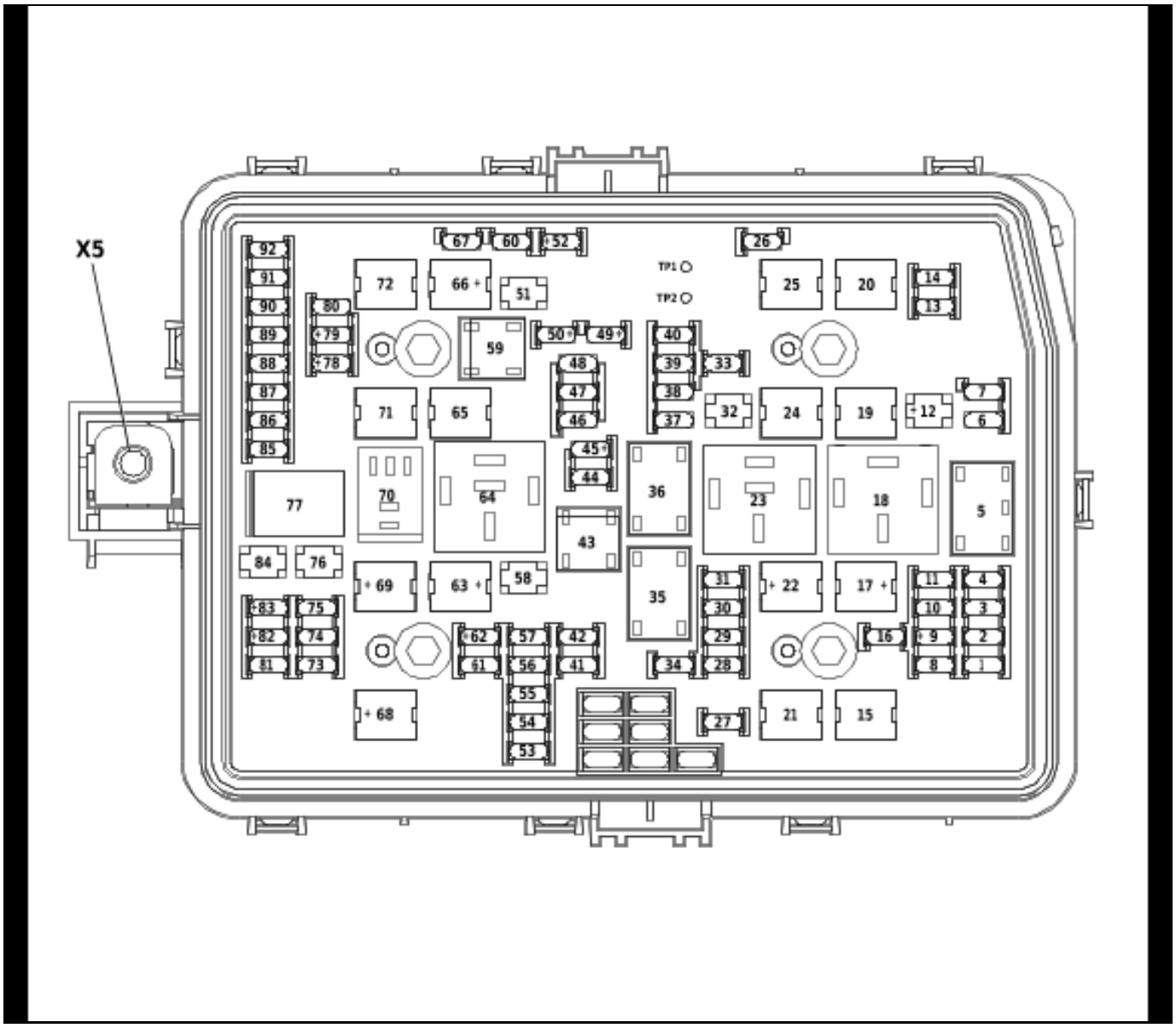
Electrical Center Identification Views

X50A Fuse Block - Underhood Label



4894090

X50A Fuse Block - Underhood Top View



4894093

Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	HI BEAM LT	F1UA	10A	• E4E Headlamp - Left High Beam • X107 Accessory Wiring Harness Package - Snow Plow Tee Left to Snow Plow Headlight - Left (UNL)
2	HI BEAM RT	F2UA	10A	• E4F Headlamp - Right High Beam • X117 Accessory Wiring Harness Package - Snow Plow Tee Right to Snow Plow Headlight - Right (UNL)
3	WASH PUMP	F3UA	15A	• G24 Windshield Washer Pump
7	UPPFITERS 3 and 4	F7UA	5A	• F6DR
8	FOG LAMP	F8UA	15A	• E29LF Fog Lamp - Left Front (T3U) • E29RF Fog Lamp - Right Front (T3U)
9	RVC	F9UA	5A	• K9 Body Control Module

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
10	UPPFITERS 1 and 2	F10UA	5A	• F5DL
12	4WD TREC	F12UA	30A	• K69 Transfer Case Control Module (NQF)
13	LR_STP_TRN_LA-MP	F13UA	15A	• E5S Tail/Stop and Turn Signal Lamp - Left (-UEA) • E42L Tail Lamp Assembly - Left (UEA) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
14	RR_STP_TRN_L-AMP	F14UA	15A	• E5T Tail/Stop and Turn Signal Lamp - Right (-UEA) • E42R Tail Lamp Assembly - Right (UEA) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
17	IECL 1	F17UA	60A	• X51L Fuse Block - Instrument Panel Left
22	IECL 2	F22UA	60A	• X51L Fuse Block - Instrument Panel Left
26	RR AMBER	F26UA	15A	• X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
27	HORN	F27UA	15A	• P12 Horn
32	REAR DEFOG	F32UA	30A	• E18 Rear Defogger Grid (C49)
33	HTD MIR	F33UA	15A	• E17D Outside Rearview Mirror Glass - Driver (DPN) • E17P Outside Rearview Mirror Glass - Passenger (DPN)
34	PRK LAMP LT	F34UA	15A	• E2LM Side Marker Lamp - Left Middle (DPN) • E3A Roof Clearance Lamp - Left Front Outer • E3C Roof Clearance Lamp - Front Middle • E3E Roof Clearance Lamp - Right Front Outer • E4S Park/Turn Signal Lamp - Left Upper • E4Q Park/Turn Signal Lamp - Left Lower • E5S Tail/Stop and Turn Signal Lamp - Left (-UEA) • E42L Tail Lamp Assembly - Left (UEA) • X107 Accessory Wiring Harness Package - Snow Plow Tee Left to Snow Plow Headlight - Left (UNL) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
37	MSTRAIDS LAIR	F37UA	5A	• X231 Body Wiring Harness to Upfitter Wiring Harness
39	AIR DRYER	F39UA	20A	• E91 Air Dryer Valve Heater (JPY)
40	MISC IGN	F40UA	10A	• S48A Multifunction Switch - Instrument Panel • X191 Engine Wiring Harness - Chassis to Engine Wiring Harness - Chassis (PTO)
41	TRLR PRK LAMP	F41UA	20A	• X88 Trailer Connector (UY7)

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
42	PRK LAMP RT	F42UA	15A	• E2RM Side Marker Lamp - Right Middle (DPN) • E4R Park/Turn Signal Lamp - Right Lower • E4T Park/Turn Signal Lamp - Right Upper • E5T Tail/Stop and Turn Signal Lamp - Right (-UEA) • E42R Tail Lamp Assembly - Right (UEA) • X117 Accessory Wiring Harness Package - Snow Plow Tee Right to Snow Plow Headlight - Right (UNL) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
44	FUEL PUMP	F44UA	20A	• Not Used
45	LOW AIR PRESS	F45UA	15A	• KR99 Air Suspension Relay
46	ECM IGN	F46UA	15A	• K20 Engine Control Module • K38A Chassis Control Module - Auxiliary (JL1) • K111 Fuel Pump Control Module
47	TRANS IGN	F47UA	15A	• K34 Glow Plug Control Module • K71 Transmission Control Module
49	TCM_BATT	F49UA	15A	• K71 Transmission Control Module
50	A/C CLTCH	F50UA	10A	• KR29 A/C Compressor Clutch Relay
52	FRT WPR	F52UA	25A	• KR12B Windshield Wiper Relay • KR12C Windshield Wiper Speed Control Relay
53	STOP LAMP	F53UA	15A	• E6 Center High Mounted Stop Lamp • K19 Suspension Control Module connector (91B/91C/91D/91E) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
54	TRLR REV LAMP	F54UA	10A	• A10 Inside Rearview Mirror (DD8) • E5A Backup Lamp - Left (-UEA) • E5B Backup Lamp - Right (-UEA) • E42L Tail Lamp Assembly - Left (UEA) • E42R Tail Lamp Assembly - Right (UEA) • P3 Backup Alarm (UZF) • X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
55	TRLR BCK/UP LAMP	F55UA	10A	• X88 Trailer Connector (UY7)
56	NOT USED	F56UA	10A	• Not Used
57	LR AMBER	F57UA	15A	• X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)
58	TRLR_BRK	F58UA	30A	• K133 Trailer Brake Power Control Module (JL1) • X61A Junction Block - Instrument Panel
62	ICCM	F62UA	10A	• K38A Chassis Control Module - Auxiliary (JL1)
63	ACCY PWR	F63UA	20A	• X405 Body Builder Connection to Chassis Front Wiring Harness (5DX) • X495 Body Builder Connection to Chassis Rear Wiring Harness - Right (5DY)

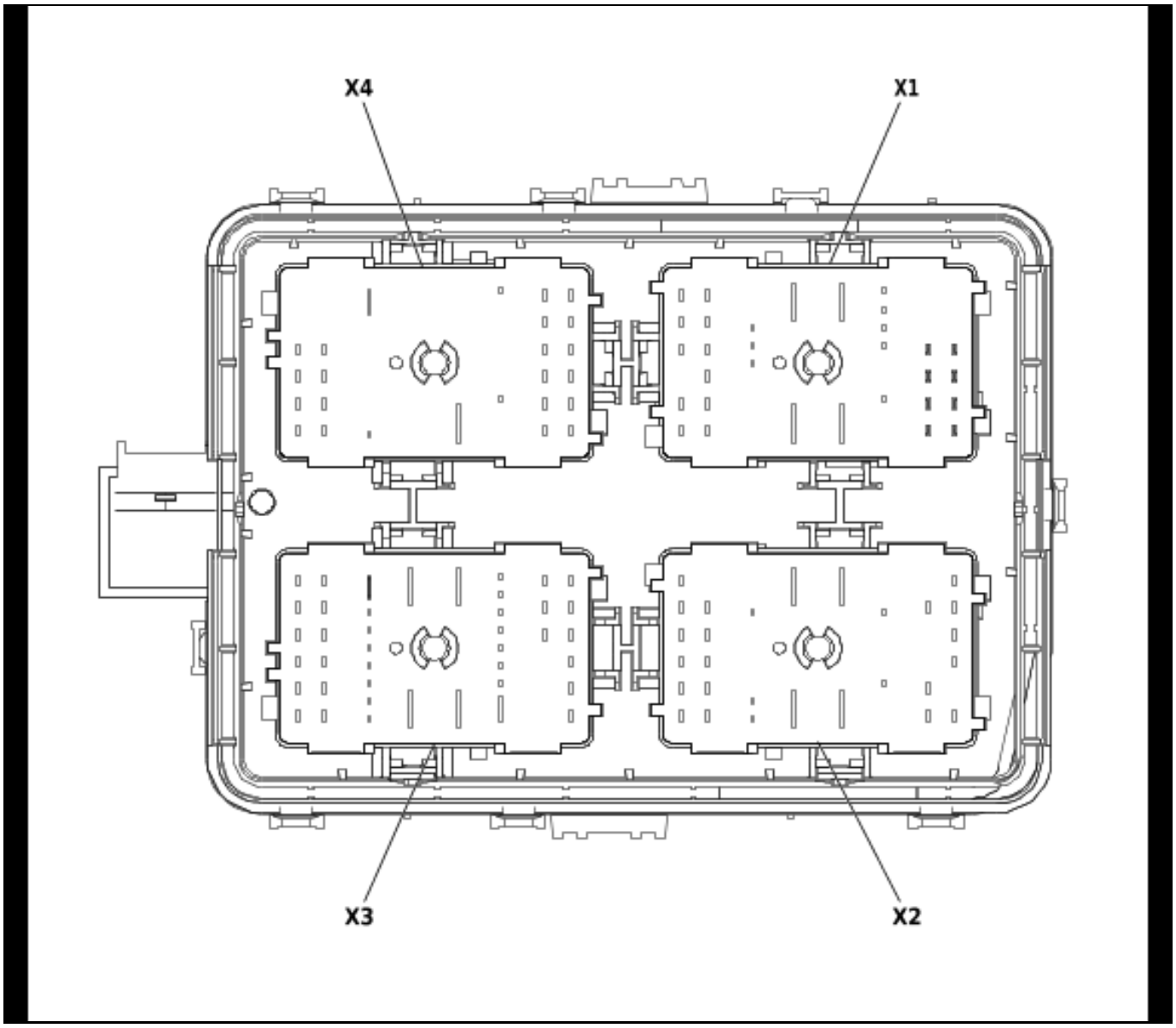
Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
66	AUX UEC	F66UA	60A	• X50B Fuse Block - Underhood Auxiliary
68	ABS PUMP	F68UA	60A	• K17 Electronic Brake Control Module
69	NOT USED	F69UA	50A	• Not Used
73	LFT_TRLR STOP_TURN	F73UA	15A	• X88 Trailer Connector (UY7)
75	NOT USED	F75UA	30A	• Not Used
78	ECM_BATT	F78UA	15A	• K20 Engine Control Module
79	CAB_HTR_AUX BATT	F79UA	10A	• K115 Reductant Control Module
81	RGT_TRLR STOP_TURN	F81UA	15A	• X88 Trailer Connector (UY7)
82	FTZM	F82UA	30A	• K111 Fuel Pump Control Module
83	ABS VALVE	F83UA	25A	• K17 Electronic Brake Control Module
84	TRLR_BATT	F84UA	30A	• X88 Trailer Connector (UY7)
85	ENG	F85UA	15A	• B75C Multifunction Intake Air Sensor
86	ECM	F86UA	30A	• K20 Engine Control Module
91	ECM THROT CONT	F91UA	15A	• K20 Engine Control Module
92	COOL FAN CLUTCH	F92UA	10A	• KR20F Cooling Fan Relay
Relays				
5	WASH PUMP	KR11 Windshield Washer Pump Relay	—	• F3UA
23	DEFOG REAR	KR5 Rear Defogger Relay	—	• F32UA • F33UA
35	PRK LAMP	KR53 Park Lamps Relay	—	• F34UA • F41UA • F42UA
36	RUN/CRNK	KR73 Ignition Main Relay	—	• F7UA • F10UA • F37UA • F39UA • F40UA • F44UA • F46UA • F47UA • KR99 Air Suspension Relay
43	LOW AIR PRESS	KR99 Air Suspension Relay	—	• Not Used
59	A/C CONTROL	KR29 A/C Compressor Clutch Relay	—	• Q2 A/C Compressor Clutch (C67)
64	LR AMBER	KR68L Turn Signal Lamps Relay - Left	—	• F57UA
70	NOT USED	—	—	• Not Used

Usage Table (cont'd)

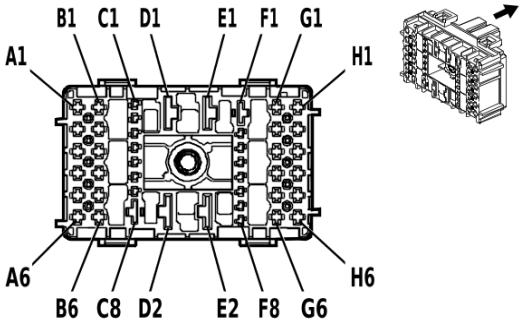
No.	Device Label Name	Device Assigned Name	Rating	Description
77	ECM	KR75 Engine Controls Ignition Relay	—	• F85UA • F86UA • F91UA • F92UA • KR29 A/C Compressor Clutch Relay
Note: Relays listed below are non-serviceable Printed Circuit Board (PCB) relays and are internal to the block.				
—	—	KR12B Windshield Wiper Relay	—	• KR12C Windshield Wiper Speed Control Relay
—	—	KR12C Windshield Wiper Speed Control Relay	—	• M75 Windshield Wiper Motor
—	—	KR3 Horn Relay	—	• F27UA
—	—	KR40 Backup Lamp Relay	—	• F54UA • F55UA
—	—	KR46 Front Fog Lamp Relay	—	• F8UA
—	—	KR48 Headlamp High Beam Relay	—	• F1UA • F2UA
—	—	KR59 Stop Lamp Relay	—	• F53UA
—	—	KR63L Trailer Stop/Turn Signal Lamp Relay - Left	—	• F73UA
—	—	KR63R Trailer Stop/Turn Signal Lamp Relay - Right	—	• F81UA
—	—	KR68R Turn Signal Lamps Relay - Right	—	• F26UA
—	—	KR150 Relay - Spare	—	• Not Used
—	—	KR182L Stop/Turn Signal Lamp Relay - Left	—	• F13UA
—	—	KR182R Stop/Turn Signal Lamp Relay - Right	—	• F14UA
Test Points				
TP1	CKT 95	TP1	—	• KR12C Windshield Wiper Speed Control Relay
TP2	CKT 92	TP2	—	• KR12C Windshield Wiper Speed Control Relay

X50A Fuse Block - Underhood Bottom View



4894101

X50A Fuse Block - Underhood X1



4994109

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33384590
Service Connector: 19370824
Description: 44-Way F 1.5, 2.8, 6.3 CTS, 9.5 MCON-LL Series(BU)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19369711	J-35616-14 (GN)	EL-38125-560A
II	84779405	J-35616-35 (VT)	J-38125-215A

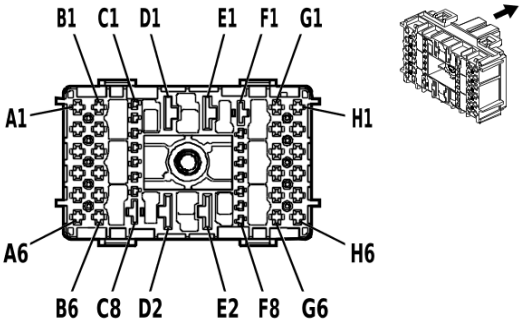
X50A Fuse Block - Underhood X1

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A1	0.75	BU / WH	1314	Left Front Turn Signal Lamp Control	II	—
A2	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	II	—
A3	0.35	BN / GY	2268	Windshield Washer Relay Control	II	—
A4	0.5	BK	550	Ground	II	—
A5	0.75	BK / WH	451	Signal Ground	II	—
A6	0.75	BN / GN	9950	Stop/Turn Signal Lamp Relay - Right Low Control	II	—
B1	—	—	—	Not Occupied	—	—
B2	2	RD / GY	1342	Battery Positive Voltage	II	—
B3 - B4	—	—	—	Not Occupied	—	—
B5	0.75	YE / BU	18	Left Rear Stop/Turn Signal Lamp Control	II	—
B6	0.75	BN / GN	19	Right Rear Stop/Turn Signal Lamp Control	II	—
C1	0.75	YE	712	Left Headlamp Low Beam Control	I	—
C2	—	—	—	Not Occupied	—	—
C3	0.75	YE	312	Right Headlamp Low Beam Control	I	—
C4 - C6	—	—	—	Not Occupied	—	—
C7	0.75	YE / BU	9960	Stop/Turn Signal Lamp Relay - Left Low Control	I	—
C8 - F1	—	—	—	Not Occupied	—	—
F2	0.35	BN / VT	193	Rear Defogger Relay Control	I	—
F3	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	I	—
F4	0.5	BU / WH	1314	Left Front Turn Signal Lamp Control	I	—

X50A Fuse Block - Underhood X1 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
F5	0.75	GN / VT	1315	Right Front Turn Signal Lamp Control	I	—
F6	0.35	WH / VT	860	Windshield Wiper Switch High Signal	I	—
F7	0.75	GN / VT	619	Right Rear Turn Signal Lamp Control	I	—
F8	0.5	GN / VT	1315	Right Front Turn Signal Lamp Control	I	—
G1	—	—	—	Not Occupied	—	—
G2	2.5	BN / VT	293	Rear Defogger Grid Control	II	—
G3	0.5	BN / YE	2267	Outside Rearview Mirror Heater Control	II	—
G4	0.35	GN / VT	5199	Run/Crank Relay Coil Control	II	—
G5	2	BK	550	Ground	II	—
G6	0.35	GY	91	Windshield Wiper Motor Relay Coil Control	II	—
H1	0.5	VT / GY	539	Run/Crank Ignition 1 Voltage	II	—
H2	2.5	RD / GN	242	Battery Positive Voltage	II	—
H3	1.5	VT / GY	139	Run/Crank Ignition 1 Voltage	II	—
H4	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	II	—
H5	2	WH	92	Windshield Wiper Motor High Speed Control	II	—
H6	2	YE / BN	95	Windshield Wiper Motor Low Speed Control	II	—

X50A Fuse Block - Underhood X2



4994132

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33384594
Service Connector: 19371174
Description: 44-Way F 1.5, 2.8, 6.3 CTS, 9.5 MCON-LL Series(GN)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19369711	J-35616-14 (GN)	EL-38125-560A
II	84779405	J-35616-35 (VT)	J-38125-215A
III	Not required	J-35616-22 (RD)	No Tool Required

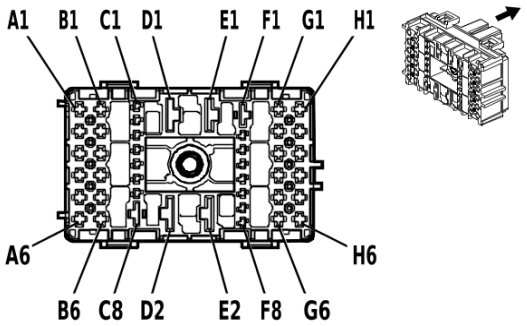
X50A Fuse Block - Underhood X2

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A1 - A2	—	—	—	Not Occupied	—	—
A3	0.5	WH	711	Left Headlamp High Beam Control	II	—
A4	0.5	WH	311	Right Headlamp High Beam Control	II	—
A5	0.5	BK	550	Ground	II	—
A6	0.75	GY / VT	228	Windshield Washer Pump Control	II	—
B1 - B2	—	—	—	Not Occupied	—	—
B3	0.5	BN / VT	2234	Front Fog Lamp Control	II	—
B4	0.5	RD / YE	2340	Battery Positive Voltage	II	—
B5	0.5	VT / GN	39	Run/Crank Ignition 1 Voltage	II	—
B6	0.75	GN / VT	1315	Right Front Turn Signal Lamp Control	II	—
C1	0.35	BU / WH	5186	Left Trailer Turn Signal Lamp Control	I	—
C2	0.35	YE / GY	5187	Right Trailer Turn Signal Lamp Control	I	—
C3	0.5	BN	1317	Fog Lamp Relay Control	I	—
C4	0.35	BN / VT	1969	Headlamp High Beam Relay Control	I	—
C5	0.75	BU / WH	1314	Left Front Turn Signal Lamp Control	I	—
C6 - D1	—	—	—	Not Occupied	—	—
D2	10	RD / VT	842	Battery Positive Voltage	III	—
E1	—	—	—	Not Occupied	—	—
E2	10	RD / BU	42	Battery Positive Voltage	III	—
F1	—	—	—	Not Occupied	—	—

X50A Fuse Block - Underhood X2 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
F2	0.5	VT / WH	5065	Stop Lamp Relay Coil Control	I	—
F3	0.35	BU / BN	38	Backup Lamp Relay Control	I	—
F4	0.35	BN / WH	28	Horn Relay Control	I	—
F5	—	—	—	Not Occupied	—	—
F6	0.75	YE	312	Right Headlamp Low Beam Control	I	—
F7	—	—	—	Not Occupied	—	—
F8	0.75	YE	712	Left Headlamp Low Beam Control	I	—
G1	0.75	BN / GY	29	Horn Control	II	—
G2	0.5	GN / WH	24	Backup Lamp Control	II	—
G3	2	RD / GN	968	Configurable Provision 4 Control	II	—
G4	0.5	BK	550	Ground	II	—
G5	0.5	YE	5530	Hood Open Switch Signal	II	—
G6 - H1	—	—	—	Not Occupied	—	—
H2	0.5	VT / GY	709	Left Park Lamp Control	II	—
H3	0.5	VT / GY	709	Left Park Lamp Control	II	—
H4	—	—	—	Not Occupied	—	—
H5	0.5	GY / BN	309	Right Park Lamp Control	II	—
H6	0.35	BU	45	Park Lamp Relay Control	II	—

X50A Fuse Block - Underhood X3



4992608

Connector Part Information

Harness Type: Engine Wiring Harness - Chassis
OEM Connector: 33384584
Service Connector: 19371176
Description: 44-Way F 1.5, 2.8, 6.3 CTS, 9.5 MCON-LL Series(GY)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19369711	J-35616-14 (GN)	EL-38125-560A
II	84779405	J-35616-35 (VT)	J-38125-215A
III	Not required	J-35616-22 (RD)	No Tool Required

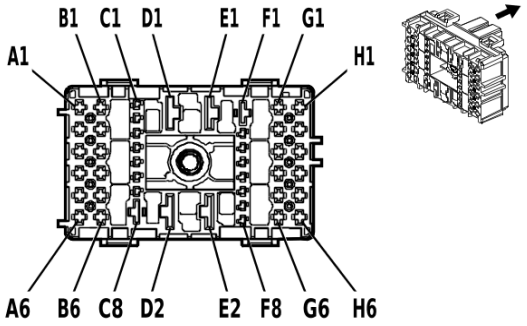
X50A Fuse Block - Underhood X3

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A1	0.5	VT / GN	439	Run/Crank Ignition 1 Voltage	II	—
A2	0.5 0.75	VT / BK GN	2139 AL123	Run/Crank Ignition 1 Voltage Run/Crank Ignition 1 Voltage	II	— —
A3	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	II	—
A4	—	—	—	Not Occupied	—	—
A5	1 1	RD RD	AL110 AL170	Battery Positive Voltage Battery Positive Voltage	II	— —
A6	0.75	BN / GN	59	A/C Compressor Clutch Control	II	—
B1 - B4	—	—	—	Not Occupied	—	—
B5	2.5	BK	550	Ground	II	—
B6	1	BK / WH	451	Signal Ground	II	—
C1	0.5	GN / GY	465	Fuel Pump Primary Relay Control	I	—
C2 - C3	—	—	—	Not Occupied	—	—
C4	0.5	WH / GY	459	A/C Compressor Clutch Relay Control	I	—
C5 - D1	—	—	—	Not Occupied	—	—
D2	10	RD / WH	342	Battery Positive Voltage	III	—
E1 - F2	—	—	—	Not Occupied	—	—
F3	0.5	RD / BN	440	Battery Positive Voltage	I	—
F4	0.5	YE	5991	Powertrain Relay Coil Control	I	—
F5	0.75	RD / WH	3440	Battery Positive Voltage	I	—

X50A Fuse Block - Underhood X3 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
F6	—	—	—	Not Occupied	—	—
F7	0.5	GY / YE	5297	Exhaust Camshaft Position Sensor 1 Voltage Reference	I	—
F8	—	—	—	Not Occupied	—	—
G1	0.5	VT / BU	5294	Powertrain Main Relay Fused Supply Voltage 5	II	—
G2 - G6	—	—	—	Not Occupied	—	—
H1	2.5	VT / BU	5290	Powertrain Main Relay Fused Supply Voltage 1	II	—
H2 - H5	—	—	—	Not Occupied	—	—
H6	0.75	VT / BU	5290	Powertrain Main Relay Fused Supply Voltage 1	II	—

X50A Fuse Block - Underhood X4



4993031

Connector Part Information

Harness Type: Chassis Front Wiring Harness
OEM Connector: 4110744C1
Service Connector: 19371188
Description: 44-Way F 1.5, 2.8, 6.3 CTS, 9.5 MCON-LL Series(BK)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19369711	J-35616-14 (GN)	EL-38125-560A
II	84779405	J-35616-35 (VT)	J-38125-215A
III	Not Available	J-35616-35 (VT)	J-38125-212
IV	Not required	J-35616-22 (RD)	No Tool Required

X50A Fuse Block - Underhood X4

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A1	0.75	VT / GY	1054	Stop Lamp Control	II	—
A2	2	VT / GY	709	Left Park Lamp Control	II	—
A3	5	GY / BN	2109	Trailer Park Lamp Control	III	—
A4	2	GY / BN	309	Right Park Lamp Control	II	—
A5	—	—	—	Not Occupied	—	—
A6	0.5	PK	1739	Run/Crank Ignition 1 Voltage	II	—
B1	2	GN / WH	24	Backup Lamp Control	II	—
B2	2	WH / GN	1624	Trailer Backup Lamp Control	II	—
B3	—	—	—	Not Occupied	—	—
B4	2	YE / BN	618	Left Rear Turn Signal Lamp Control	II	—
B5	1.5	VT / GN	439	Run/Crank Ignition 1 Voltage	II	—
B6 - C6	—	—	—	Not Occupied	—	—
C7	1	RD	2040	Battery Positive Voltage	I	—
C8 - D1	—	—	—	Not Occupied	—	—
D2	10	RD / YE	442	Battery Positive Voltage	IV	—
E1	10	RD / YE	1042	Battery Positive Voltage	IV	—
E2 - F5	—	—	—	Not Occupied	—	—
F6	0.5	GN / GY	465	Fuel Pump Primary Relay Control	I	—
F7 - G2	—	—	—	Not Occupied	—	—

X50A Fuse Block - Underhood X4 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
G3	1.5	YE / BU	318	Left Rear Trailer Stop/Turn Lamp Control	II	—
G4 - G5	—	—	—	Not Occupied	—	—
G6	2	RD / GN	1142	Battery Positive Voltage	II	—
H1 - H2	—	—	—	Not Occupied	—	—
H3	2	GN / BN	319	Right Rear Trailer Stop/Turn Lamp Control	II	—
H4	2.5	RD / VT	A40	Secondary Fused Battery Positive Voltage	II	—
H5	2	RD / VT	1940	Battery Positive Voltage	II	—
H6	2	RD / YE	1242	Battery Positive Voltage	II	—

X50A Fuse Block - Underhood X5

—

Connector Part Information

Harness Type: Battery Distribution Engine Compartment Cable
OEM Connector: Not Available
Service Connector: Service by Cable Assembly — See Part Catalog
Description: Ring Terminal

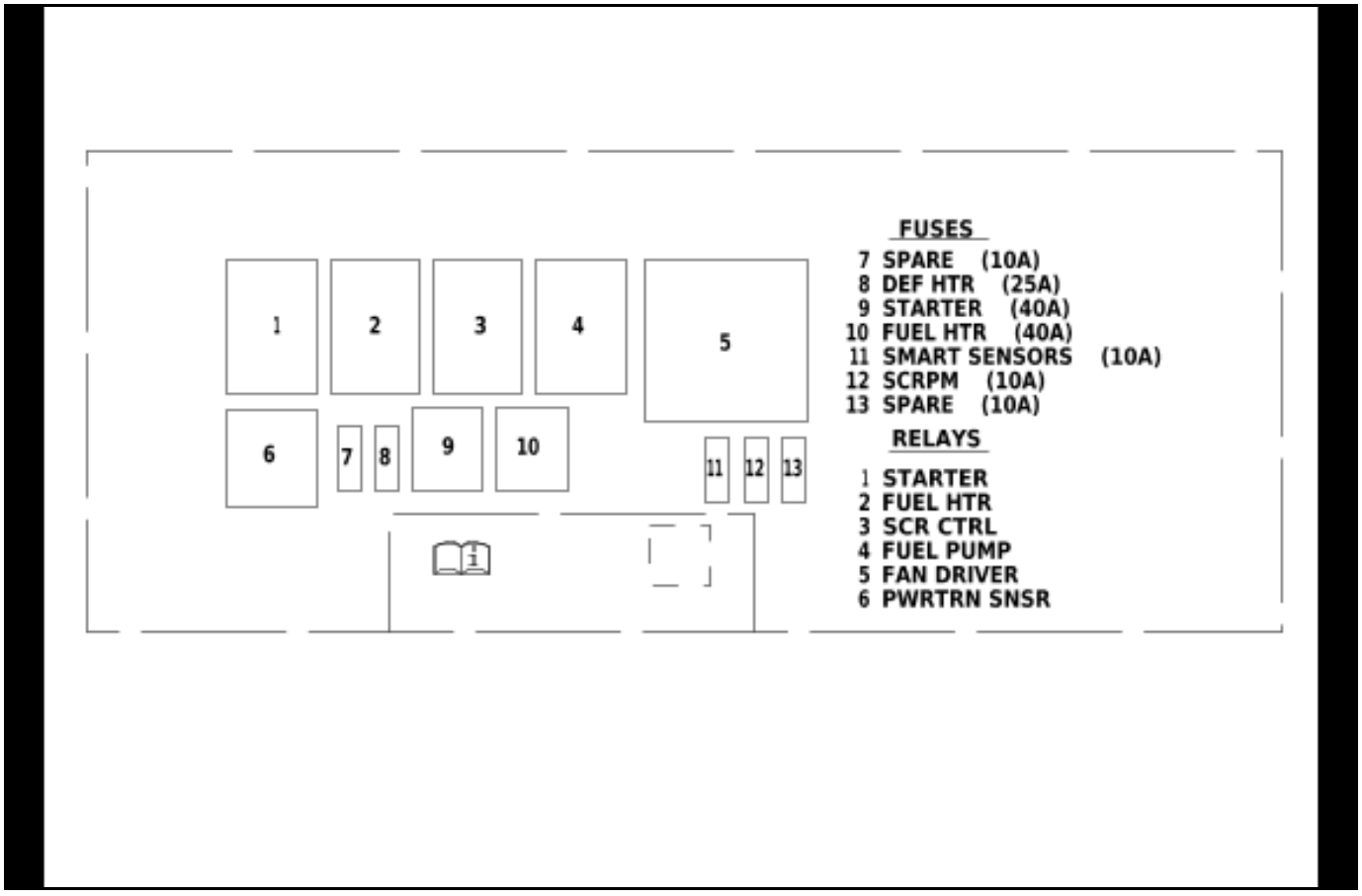
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50A Fuse Block - Underhood X5

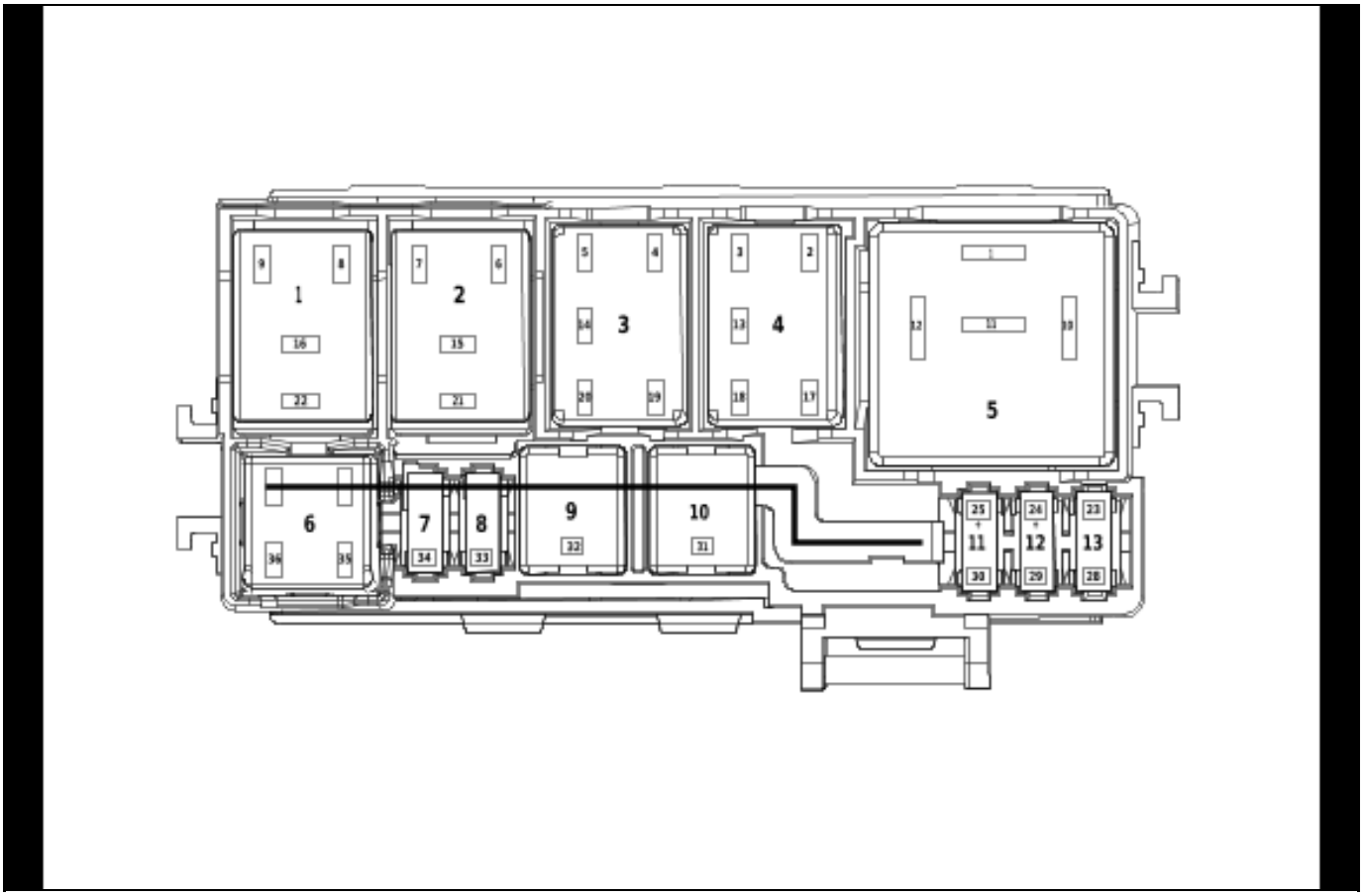
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	—	RD	842	Battery Positive Voltage	I	—

X50B Fuse Block - Underhood Auxiliary Label



4917818

X50B Fuse Block - Underhood Auxiliary Top View



4894087

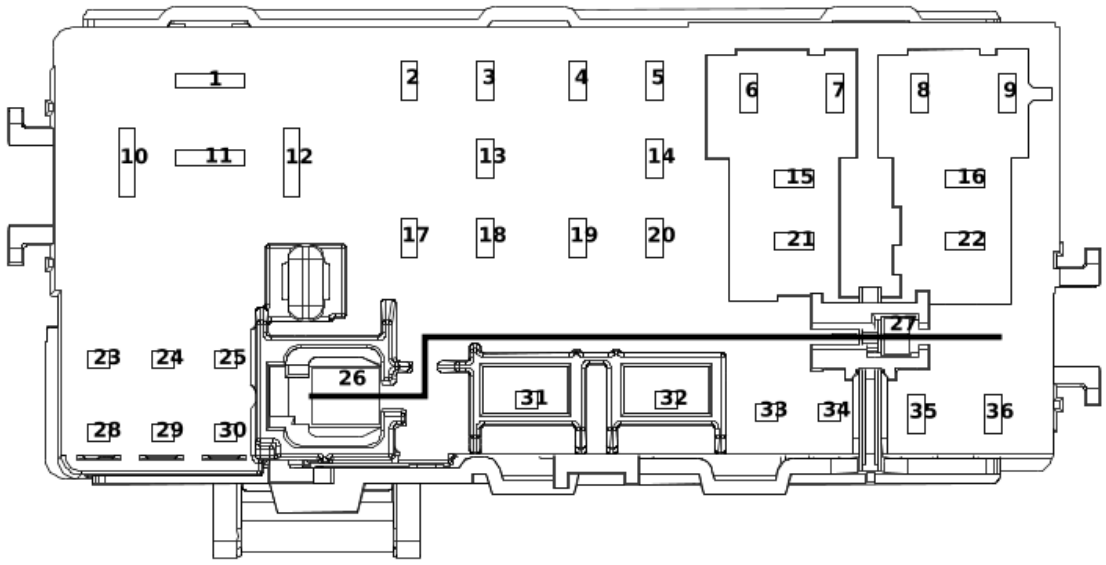
Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
7	SPARE	F7UB	—	• Not Used
8	DEF HTR	F8UB	25A	• KR121A Reductant Control Module Relay 1
9	STARTER	F9UB	40A	• KR27 Starter Relay
10	FUEL HTR	F10UB	40A	• KR22 Fuel Heater Relay
11	SMART SENSORS	F11UB	10A	• B136 Exhaust Particulate Sensor • B195A Nitrogen Oxides Sensor 1 • B195B Nitrogen Oxides Sensor 2 • K111 Fuel Pump Driver Control Module • M103 Turbocharger Vane Position Actuator
12	SCRPM	F12UB	10A	• K111 Fuel Pump Driver Control Module • K115 Reductant Control Module
13	SPARE	F13UB	—	• Not Used
Relays				
1	STARTER	KR27 Starter Relay	—	• M64 Starter Motor
2	FUEL HTR	KR22 Fuel Heater Relay	—	• E11A Fuel Heater/Water in Fuel Sensor
3	SCR CTRL	KR121A Reductant Control Module Relay 1	—	• K115 Reductant Control Module

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
4	FUEL PUMP	KR23B Fuel Pump Relay - Secondary	—	• Not Used
5	FAN DRIVER	KR20F Cooling Fan Relay	—	• Q85 Cooling Fan Clutch
6	PWRTRN SNSR	KR121B Reductant Control Module Relay 2	—	• F11UB • F12UB

X50B Fuse Block - Underhood Auxiliary Wire Entry



4894089

Connector Part Information

Harness Type: Engine Wiring Harness - Chassis
OEM Connector: 35209870
Service Connector: Service by Component Assembly - See Part Catalog
Description: Wire Entry Fuse Block

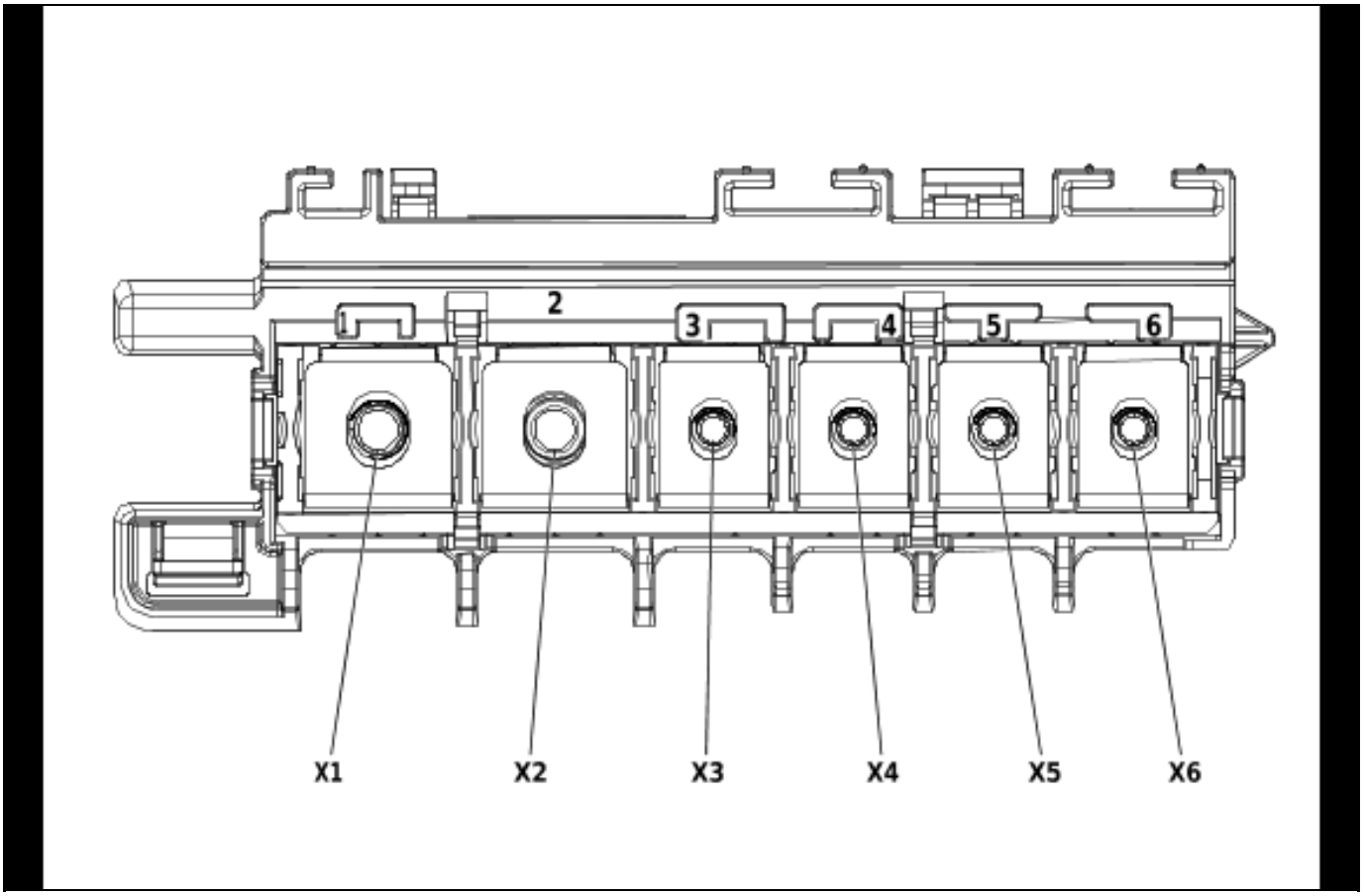
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19371175	J-35616-2A (GY)	J-38125-11A
II	Not required	J-35616-22 (RD)	No Tool Required
III	Not required	J-35616-35 (VT)	No Tool Required
IV	Not required	J-35616-42 (RD)	No Tool Required
V	Not required	J-35616-43 (RD)	No Tool Required

X50B Fuse Block - Underhood Auxiliary Wire Entry

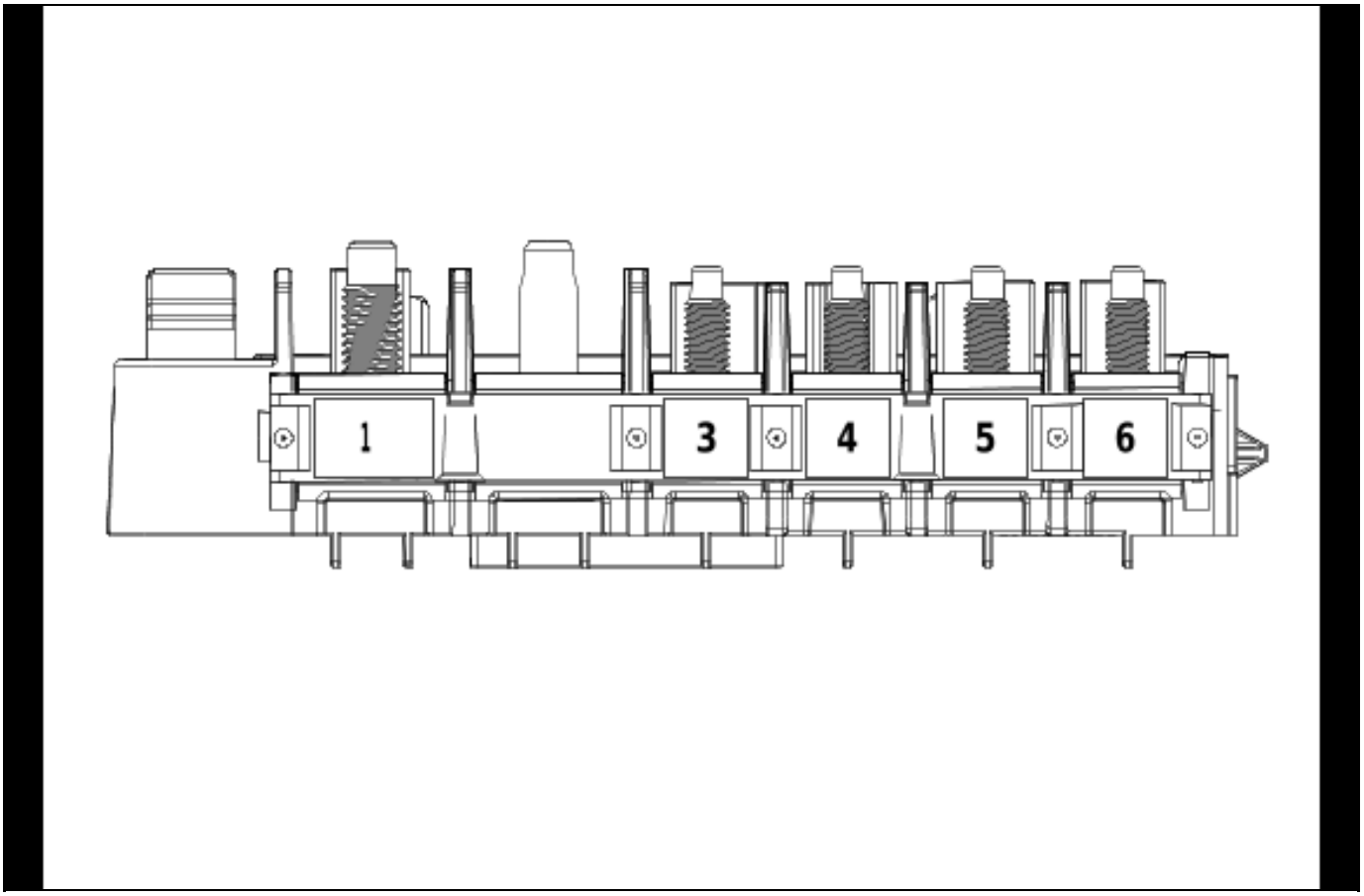
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	0.5	GY / YE	5297	Exhaust Camshaft Position Sensor 1 Voltage Reference	I	—
4	0.5	GN / BU	3889	Powertrain Sensor Bus Relay Control	III	—
5	2.5	BU	3921	Diesel Exhaust Fluid Heater Control 1	III	—
6	0.5	BU / GN	7071	Fuel Heater Control	IV	—
7	0.5	VT / GN	355	Fuel Filter Heater Control Circuit	IV	—
8	1	BK	550	Ground	IV	—
9	0.5	YE / BK	625	Starter Enable Relay Control	IV	—
10	1	BK	550	Ground	I	—
11	0.5	WH	2368	Cooling Fan Control Signal	I	—
12	0.5	WH / BK	2366	Cooling Fan Speed Control Signal	I	—
15	2.5	VT / GN	355	Fuel Filter Heater Control Circuit	IV	—
16	3	YE / VT	6	Starter Solenoid Crank Ignition Voltage	IV	—
19	0.5 2.5	RD / WH RD / WH	1340 1340	Battery Positive Voltage Battery Positive Voltage	III	— —
20	0.5	RD / WH	1340	Battery Positive Voltage	III	—
21	2.5	VT / GN	355	Fuel Filter Heater Control Circuit	IV	—
22	2.5	RD / BU	1240	Battery Positive Voltage	IV	—
24	0.5	VT / BU	974	Reductant Control Module Relay 2 Suppiled Power	III	—
25	2.5	VT / BU	974	Reductant Control Module Relay 2 Suppiled Power	III	—
26	10	RD / WH	342	Battery Positive Voltage	II	—
29	0.5	VT / GN	4320	Powertrain Sensor Bus Enable	III	—
30	2.5	VT / BU	3674	NOx Sensor 1 Control	III	—
31	2.5	VT / GN	355	Fuel Filter Heater Control Circuit	V	—
32	2.5	RD / BU	1240	Battery Positive Voltage	V	—
33	2.5	RD / WH	1340	Battery Positive Voltage	III	—
35	0.5 2.5	VT / BU VT / BU	974 974	Reductant Control Module Relay 2 Suppiled Power Reductant Control Module Relay 2 Suppiled Power	III	— —
36	0.5	GN / BU	3889	Powertrain Sensor Bus Relay Control	III	—

X50D Fuse Block - Battery Top View



4894079

X50D Fuse Block - Battery Side View

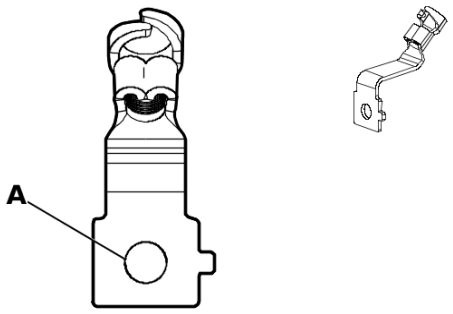


4894085

Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	—	F1BA	250A	• G13 Generator • X50A Fuse Block Underhood
2	—	—	—	• C1 Battery
3	—	F3BA	125A	• K34 Glow Plug Control Module
4	—	F4BA	100A	• E40 Electrical Auxiliary Heater (C32)
5	—	F5BA	60A	• X51R Fuse Block - Instrument Panel Right
6	—	F6BA	60A	• X51R Fuse Block - Instrument Panel Right

X50D Fuse Block - Battery X1 (Fuse Block)



5239090

Connector Part Information

Harness Type: Battery Distribution Engine Compartment Cable
OEM Connector: 13591949
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

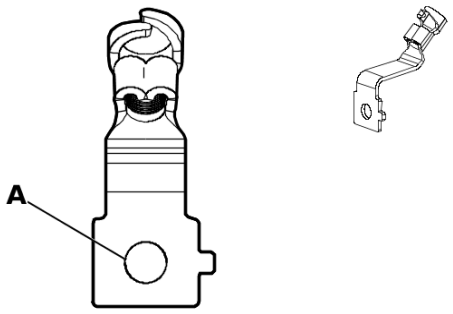
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X1 (Fuse Block)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	—	RD	842	Battery Positive Voltage	I	—

X50D Fuse Block - Battery X1 (Generator)



5239090

Connector Part Information

Harness Type: Generator Battery Jumper Cable
OEM Connector: 13591949
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

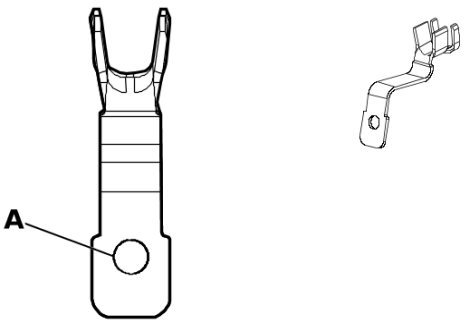
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X1 (Generator)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	—	RD	2	Battery Positive Voltage	I	—

X50D Fuse Block - Battery X2



5239188

Connector Part Information

Harness Type: Battery Positive/Fuse Block - Battery Power
OEM Connector: 161987
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

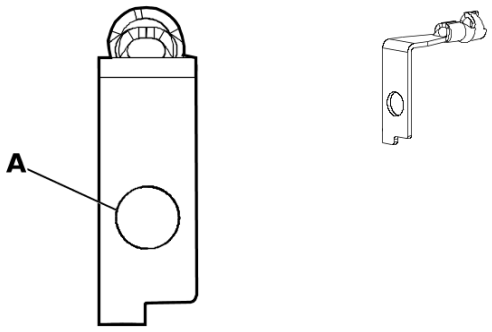
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X2

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	—	RD	1	Unfused Battery Positive Voltage	I	—

X50D Fuse Block - Battery X3



5239337

Connector Part Information

Harness Type: Diesel Glowplug Wiring Harness
OEM Connector: BDI 12386
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

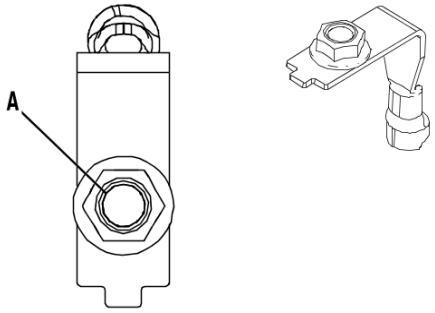
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X3

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	—	RD	842	Battery Positive Voltage	I	—

X50D Fuse Block - Battery X4 (C32)



4425476

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33265775
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

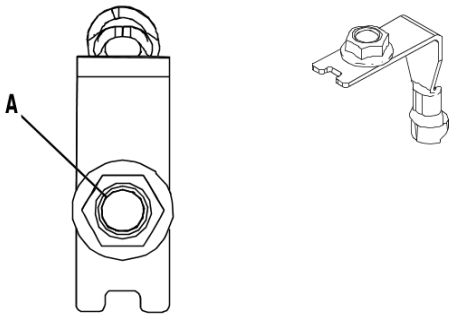
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X4 (C32)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	10	RD / GY	642	Battery Positive Voltage	I	—

X50D Fuse Block - Battery X5



4426162

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33265821
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

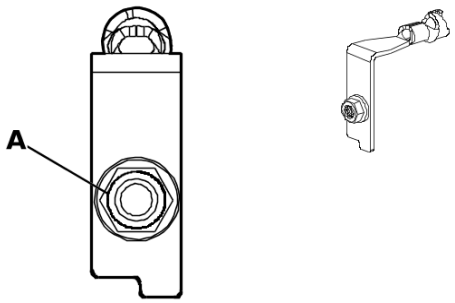
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X5

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	6	RD / GY	142	Battery Positive Voltage	I	—

X50D Fuse Block - Battery X6



5162282

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 35077346
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

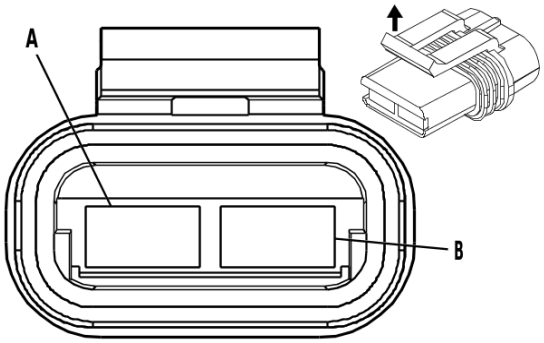
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50D Fuse Block - Battery X6

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	6	RD / GN	242	Battery Positive Voltage	I	—

X55BA Fuse Holder 1 - Brake Booster



523591

Connector Part Information

Harness Type: Brake Pedal Position Sensor Harness
OEM Connector: 1667639C1
Service Connector: Service by Harness - See Part Catalog
Description: 2-Way F 630 Metri-Pack Series, Sealed(BK)

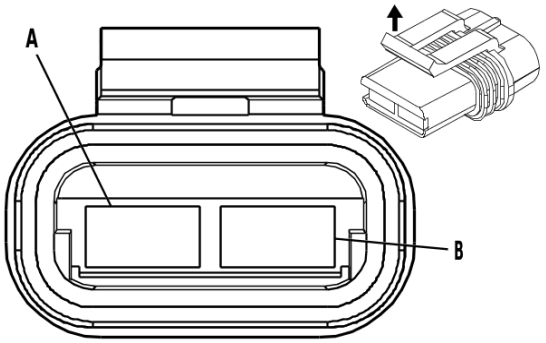
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-42 (RD)	No Tool Required

X55BA Fuse Holder 1 - Brake Booster

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	2	YE / GY	90DC	Battery Positive Voltage	I	—
B	2	GY	90EA	Battery Positive Voltage	I	—

X55BB Fuse Holder 2 - Brake Booster



523591

Connector Part Information

Harness Type: Brake Pedal Position Sensor Harness
OEM Connector: 1667639C1
Service Connector: Service by Harness - See Part Catalog
Description: 2-Way F 630 Metri-Pack Series, Sealed(BK)

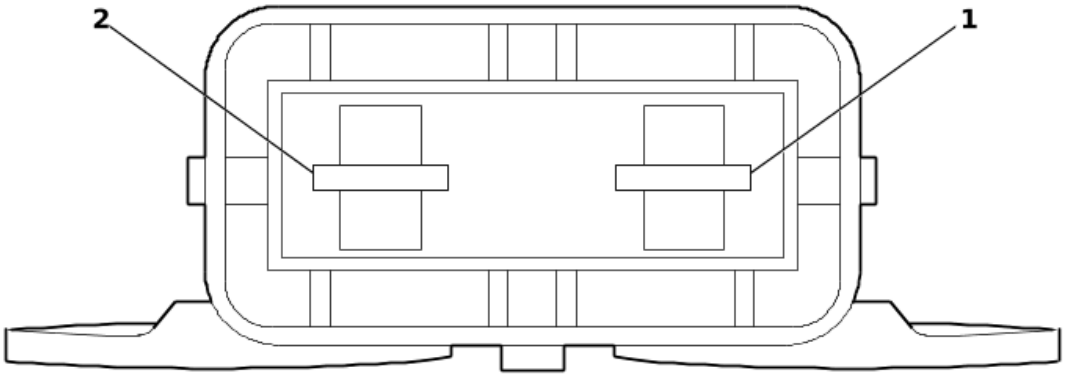
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-42 (RD)	No Tool Required

X55BB Fuse Holder 2 - Brake Booster

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	2	GY	90H	Brake Booster Pump Motor Active Signal	I	—
B	2	GY	90HB	Brake Booster Pump Motor Active Signal	I	—

X55BC Fuse Holder 3 - Brake Booster



5211405

Connector Part Information

Harness Type: Battery to Battery Cable
OEM Connector: Not Available
Service Connector: Service by Harness - See Part Catalog
Description: 2-Way F Maxi-Fuseholder

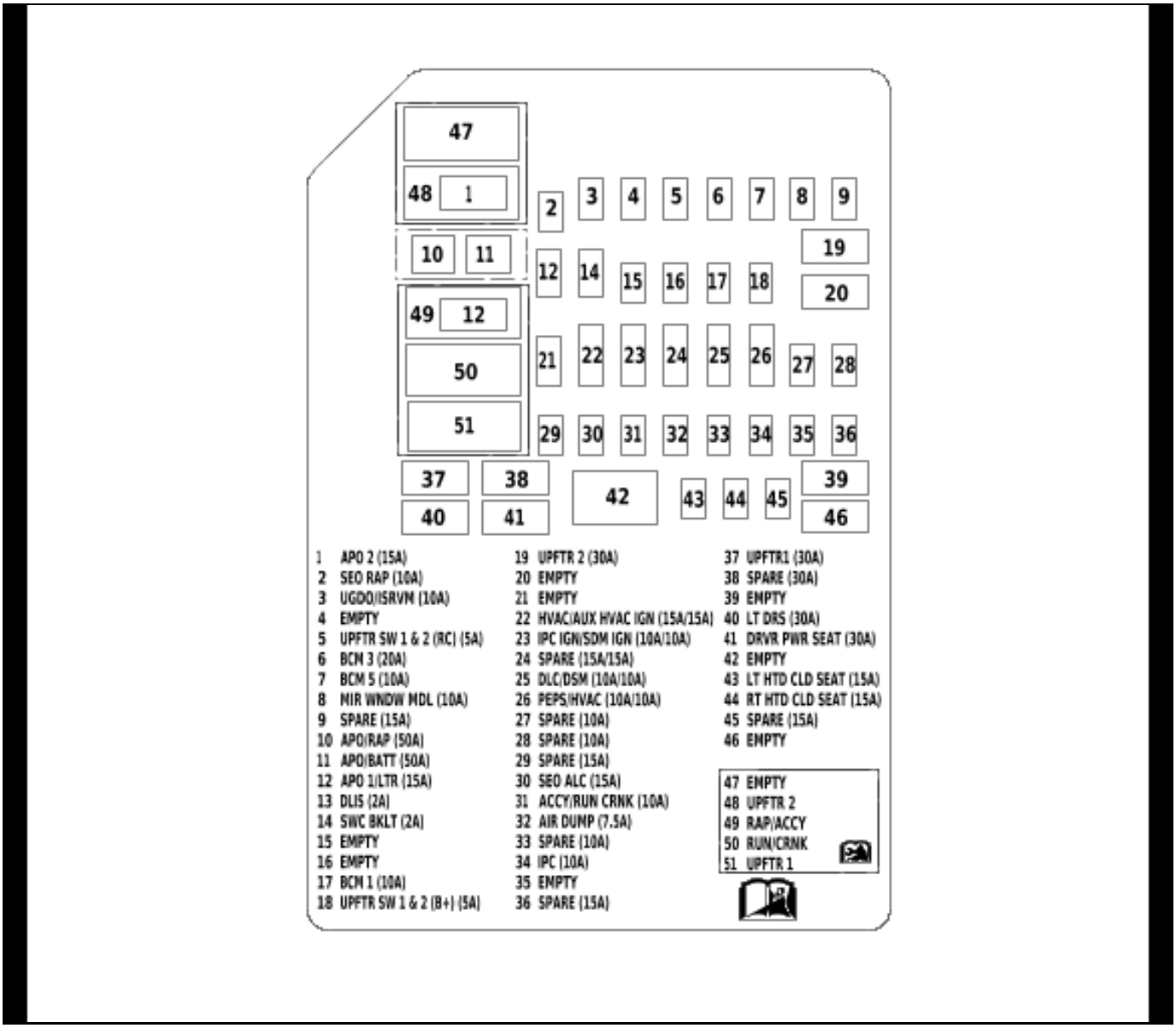
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X55BC Fuse Holder 3 - Brake Booster

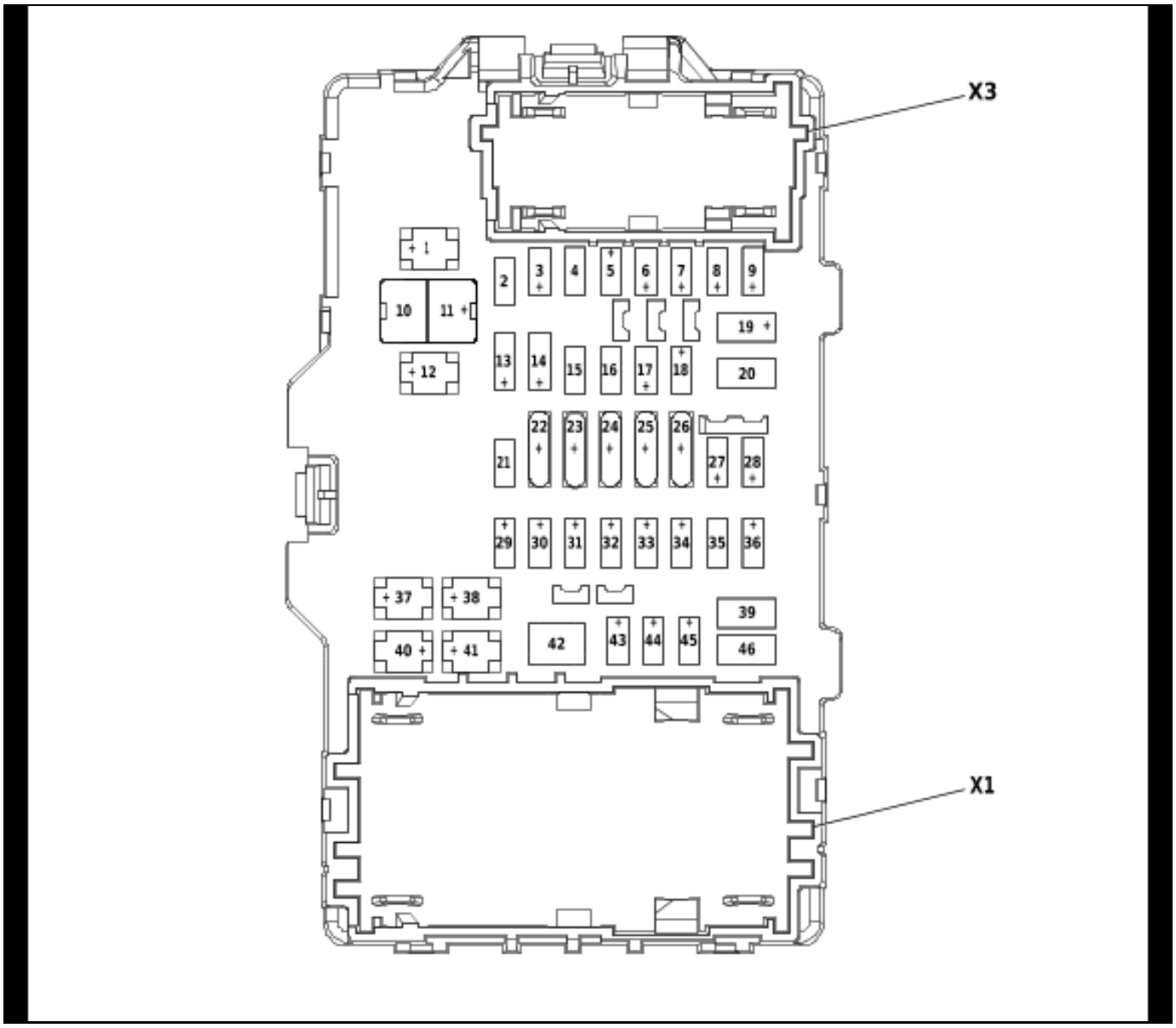
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	—	RD	1	Unfused Battery Positive Voltage	I	—
2	—	RD	90J	Battery Positive Voltage	I	—

X51L Fuse Block - Instrument Panel Left Label



4894103

X51L Fuse Block - Instrument Panel Left Top View



4894104

Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	APO 2	F1DL	15A	• X80G Accessory Power Receptacle - Instrument Panel (-D07) • X80K Accessory Power Receptacle - Instrument Panel 2 (D07)
2	SEO RAP	F2DL	10A	• X61A Junction Block-Instrument Panel • T22 Modile Device Wireless Charger Module (K4C)
3	UGDO/ISRVM	F3DL	10A	• S63 Roof Beacon Switch (TRW)
4	EMPTY	F4DL	—	• Not Used
5	UPFTR SW 1 and 2 (RC)	F5DL	5A	• KR161A Configurable Provision Relay 1 (9L7) • KR161B Configurable Provision Relay 2 (9L7)

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
6	BCM 3	F6DL	20A	• K9 Body Control Module • E4H Headlamp - Right Low Beam • E4S Park/Turn Signal Lamp - Left Upper • E4Q Park/Turn Signal Lamp - Left Lower • E4Y Turn Signal Reapeater Lamp - Left (DPN) • KR68L Turn Signal Lamps Relay - Left (5DX/5DY) • X107 Accessory Wiring Harness Package - Snow Plow Tee Left to Snow Plow Headlight - Left (UNL)
7	BCM 5	F7DL	10A	• K9 Body Control Module • KR40 Backup Lamp Relay • KR113 Child Security Lock Disable Relay • KR114 Door Dead Lock Relay • S48A Multifunction Switch - Instrument Panel • S77 Transfer Case Shift Control Switch (NQF) • S79D Window Switch - Driver (Crew Cab)
8	MIR WNDW MDL	F8DL	10A	• S52 Outside Rearview Mirror Switch (DPN) • S79D Window Switch - Driver (A31)
9	SPARE	F9DL	15A	• Not Used
10	APO/RAP	F10DL	50A	• F1DL • F12DL
11	APO/BATT	F11DL	50A	• F1DL • F12DL
12	APO 1/LTR	F12DL	15A	• X80J Accessory Power Receptacle - Instrument Panel 1 (D07)
13	DLIS	F13DL	2A	• S39 Ignition Switch
14	SWC BKLT	F14DL	2A	• S70L Steering Wheel Controls Switch - Left (-UK3)
15	EMPTY	F15DL	—	• Not Used
16	EMPTY	F16DL	—	• Not Used

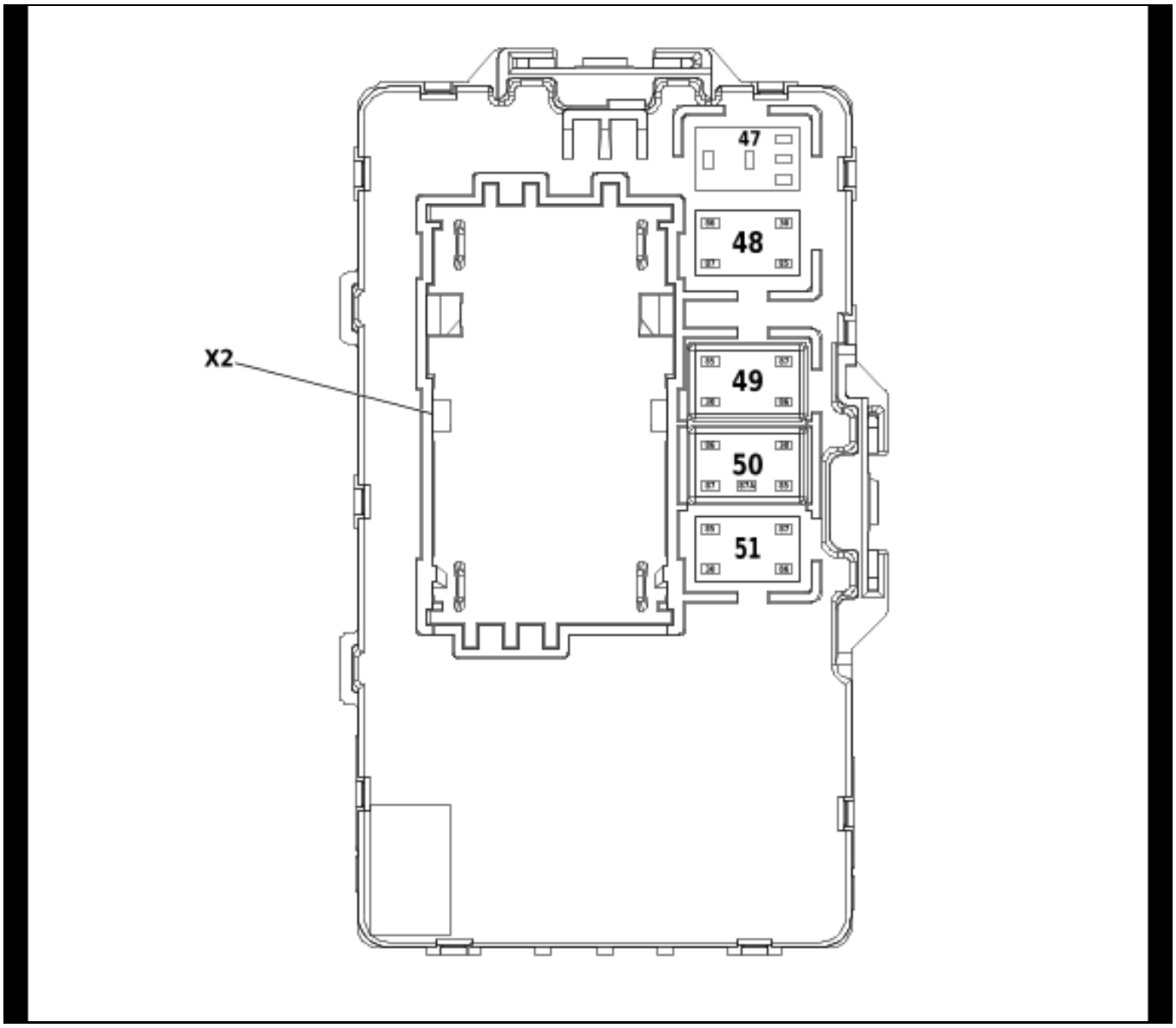
Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
17	BCM 1	F17DL	10A	• K9 Body Control Module • E1L Accent Lamp - Overhead Console • E63D Flood Lamp - Driver Door Handle (A31) • E63P Flood Lamp - Passenger Door Handle (A31) • K17 Electronic Brake Control Module • K20 Engine Control Module • K34 Glow Plug Control Module • K36 Inflatable Restraint Sensing and Diagnostic Module • K38A Chassis Control Module - Auxiliary (JL1) • K44 Power Take-Off Control Module (PTO) • K56 Serial Data Gateway Module • K69 Transfer Case Control Module (NQF) • K71 Transmission Control Module • K73 Telematics Communication Interface Control Module (UE1) • K74 Human Machine Interface Control Module (IO5) • K77 Remote Control Door Lock Receiver • K89 Immobilizer Control Module • KR11 Windshield Washer Pump Relay • KR12B Windshield Wiper Relay • KR59 Stop Lamp Relay • KR73 Ignition Main Relay (X50A Fuse Block Underhood) • KR73 Ignition Main Relay (X51L Fuse Block Instrument Panel - Left) • KR112 Cargo Lamp Relay • S48A Multifunction Switch - Instrument Panel • S70L Steering Wheel Controls Switch - Left • R50 Brake Booster Diode
18	UPFTR SW 1 and 2 (B+)	F18DL	5A	• KR161A Configurable Provision Relay 1 (9L7) • KR161B Configurable Provision Relay 2 (9L7)
19	UPFTR 2	F19DL	30A	• X61A Junction Block-Instrument Panel
20	EMPTY	F20DL	—	• Not Used
21	EMPTY	F21DL	—	• Not Used
22	HVAC/AUX HVAC IGN	F22DL	15A/15A	• K33 HVAC Control Module • E40 Electrical Auxiliary Heater (C32)
23	IPC IGN/SDM IGN	F23DL	10A/10A	• B99 Steering Wheel Angle Sensor • P14 Passenger Air Bag Disable Indicator (C99) • P16 Instrument Cluster
24	SPARE	F24DL	15A/15A	• Not Used
25	DLC/DSM	F25DL	10A/10A	• X84 Data Link Connector
26	PEPS/HVAC	F26DL	10A/10A	• K33 HVAC Control Module • K56 Serial Data Gateway Module
27	SPARE	F27DL	10A	• Not Used
28	SPARE	F28DL	10A	• Not Used
29	SPARE	F29DL	15A	• Not Used
30	SEO ALC	F30DL	15A	• X61A Junction Block-Instrument Panel

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
31	ACCY/RUN CRNK	F31DL	10A	• A10 Inside Rearview Mirror (DD8) • B87 Rearview Camera (UVC) • K69 Transfer Case Control Module (NQF) • S48A Multifunction Switch - Instrument Panel
32	AIR DUMP	F32DL	7.5A	• KR193 Rear Air Suspension Control Relay • S48A Multifunction Switch - Instrument Panel
33	SPARE	F33DL	10A	• Not Used
34	IPC	F34DL	10A	• A26 HVAC Controls • P16 Instrument Cluster • P17 Info Display Module (IO3/IO5) • S32D Seat Heating Switch - Driver (KA1) • S32P Seat Heating Switch - Passenger (KA1)
35	EMPTY	F35DL	—	• Not Used
36	SPARE	F36DL	15A	• Not Used
37	UPFTR 1	F37DL	30A	• X61A Junction Block-Instrument Panel
38	SPARE	F38DL	30A	• Not Used
39	EMPTY	F39DL	—	• Not Used
40	LT DRS	F40DL	30A	• M74D Window Motor - Driver (A31) • S79LR Window Switch - Left Rear (Crew Cab)
41	DRVR PWR SEAT	F41DL	30A	• S64D Seat Adjuster Switch-Driver (A95/AG1)
42	EMPTY	F42DL	—	• Not Used
43	LT HTD CLD SEAT	F43DL	15A	• K29 Seat Heating Control Module (KA1)
44	RH HTD CLD SEAT	F44DL	15A	• K29 Seat Heating Control Module (KA1)
45	SPARE	F45DL	15A	• Not Used
46	EMPTY	F46DL	—	• Not Used

X51L Fuse Block - Instrument Panel Left Bottom View



4894109

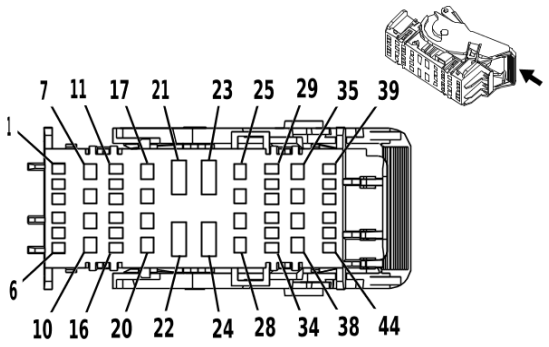
Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Relays				
47	EMPTY	—	—	• Not Used
48	UPFTR 2	KR161B Configurable Provision Relay 2	—	• F19DL
49	RAP/ACCY	KR76A Retained Accessory Power Relay 1	—	• F2DL • F10DL
50	RUN/CRNK	KR73 Ignition Main Relay	—	• F22DL • F23DL • F30DL • F31DL • F32DL • F33DL

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
51	UPFTR 1	KR161A Configurable Provision Relay 1	—	• F37DL

X51L Fuse Block - Instrument Panel Left X1



3240123

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 13967687
Service Connector: 19329455
Description: 44-Way F 1.5, 2.8, 800 Metri-Pack Series(BK)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19367554	J-35616-44 (YE)	J-38125-558
III	19368264	J-35616-4A (PU)	J-38125-11A
IV	19370817	J-35616-2A (GY)	J-38125-215A
V	84757974	J-35616-2A (GY)	J-38125-215A

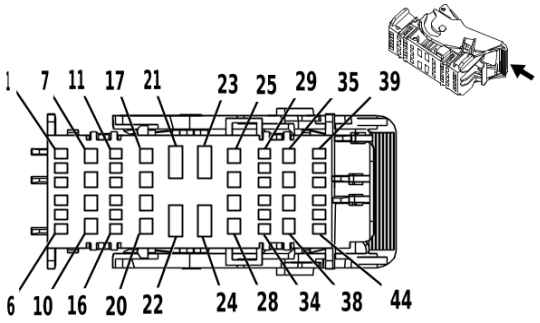
X51L Fuse Block - Instrument Panel Left X1

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 11	—	—	—	Not Occupied	—	—
12	0.5	YE / WH	962	Configurable Provision Relay 2 Control	V	—
13 - 15	—	—	—	Not Occupied	—	—
16	0.5	RD / VT	1940	Battery Positive Voltage	V	—
17	0.75	RD / GN	6140	Battery Positive Voltage	I	—
18	0.75	RD / GN	5140	Battery Positive Voltage	I	—
19 - 20	—	—	—	Not Occupied	—	—
21	6	RD / VT	842	Battery Positive Voltage	II	—
22	—	—	—	Not Occupied	—	—
23	6	RD / BU	42	Battery Positive Voltage	II	—
24 - 26	—	—	—	Not Occupied	—	—
27	2.5	RD / YE	5040	Battery Positive Voltage	III	—
28 - 29	—	—	—	Not Occupied	—	—
30	0.5	VT / WH	1939	Run/Crank Ignition 1 Voltage	V	—
31	—	—	—	Not Occupied	—	—
32	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	V	—
33 - 34	—	—	—	Not Occupied	—	—
35	2.5	BU	965	Configurable Provision 1 Control	III	—

X51L Fuse Block - Instrument Panel Left X1 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
36	2.5	RD / BU	1842	Battery Positive Voltage	III	—
37	2.5	RD / BU	1842	Battery Positive Voltage	III	—
38	—	—	—	Not Occupied	—	—
39	0.5	RD / WH	961	Configurable Provision Relay 1 Control	V	—
40 - 41	—	—	—	Not Occupied	—	—
42	0.35	GN / VT	5199	Run/Crank Relay Coil Control	V	—
43	0.35	GY / VT	755	Retained Accessory Power Relay Coil Control	IV	—
44	0.35 0.35	VT / YE VT / YE	43 43	Accessory Ignition Voltage Accessory Ignition Voltage	IV V	K4C - K4C

X51L Fuse Block - Instrument Panel Left X2



3240119

Connector Part Information

Harness Type: Instrument Panel Wiring Harness
OEM Connector: 13967688
Service Connector: 19329456
Description: 44-Way F 1.5, 2.8, 800 Metri-Pack Series(GY)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19368264	J-35616-4A (PU)	J-38125-11A
III	19370817	J-35616-2A (GY)	J-38125-215A
IV	84757974	J-35616-2A (GY)	J-38125-215A

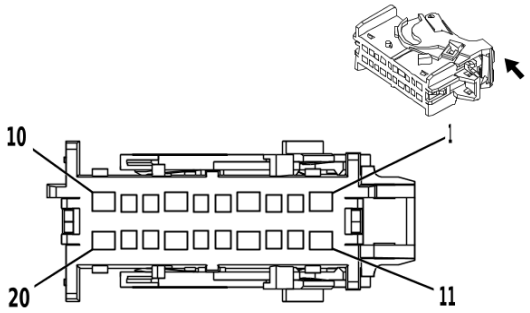
X51L Fuse Block - Instrument Panel Left X2

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 2	—	—	—	Not Occupied	—	—
3	0.5	YE	6817	LED Backlight Dimming Control 1	IV	—
4	0.35	BN	6136	Control	IV	—
5	0.35	RD / BU	540	Battery Positive Voltage	IV	—
6	0.35 0.5	VT / WH VT / WH	1139 1139	Run/Crank Ignition 1 Voltage Run/Crank Ignition 1 Voltage	III	— —
7	0.75	RD / BN	2940	Battery Positive Voltage	I	—
8	1	RD / GY	2140	Battery Positive Voltage	I	—
9	—	—	—	Not Occupied	—	—
10	1.5	RD / BN	4240	Battery Positive Voltage	II	—
11 - 12	—	—	—	Not Occupied	—	—
13	0.5	VT / GN	39	Run/Crank Ignition 1 Voltage	IV	—
14	—	—	—	Not Occupied	—	—
15	0.5	VT / GY	539	Run/Crank Ignition 1 Voltage	IV	—
16	—	—	—	Not Occupied	—	—
17	2.5	GY / BK	966	Configurable Provision 2 Control	II	—
18	0.75	RD / WH	2740	Battery Positive Voltage	I	—
19	—	—	—	Not Occupied	—	—
20	1.5	RD / WH	1040	Battery Positive Voltage	II	—

X51L Fuse Block - Instrument Panel Left X2 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
21 - 24	—	—	—	Not Occupied	—	—
25	0.35 0.5	RD / VT RD / VT	3340 3340	Battery Positive Voltage Battery Positive Voltage	I	— —
26	0.35	RD / BU	3240	Battery Positive Voltage	II	—
27	—	—	—	Not Occupied	—	—
28	0.5	VT / BK	1639	Run/Crank Ignition 1 Voltage	II	—
29 - 34	—	—	—	Not Occupied	—	—
35	0.5	RD / GY	2840	Battery Positive Voltage	II	—
36 - 37	—	—	—	Not Occupied	—	—
38	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	I	—
39 - 43	—	—	—	Not Occupied	—	—
44	0.75	BK	1850	Ground	III	—

X51L Fuse Block - Instrument Panel Left X3



3240104

Connector Part Information

Harness Type: Headlining Trim Panel Harness
OEM Connector: 15547106
Service Connector: 13597270
Description: 20-Way F 1.5, 2.8 OCS Series(BK)

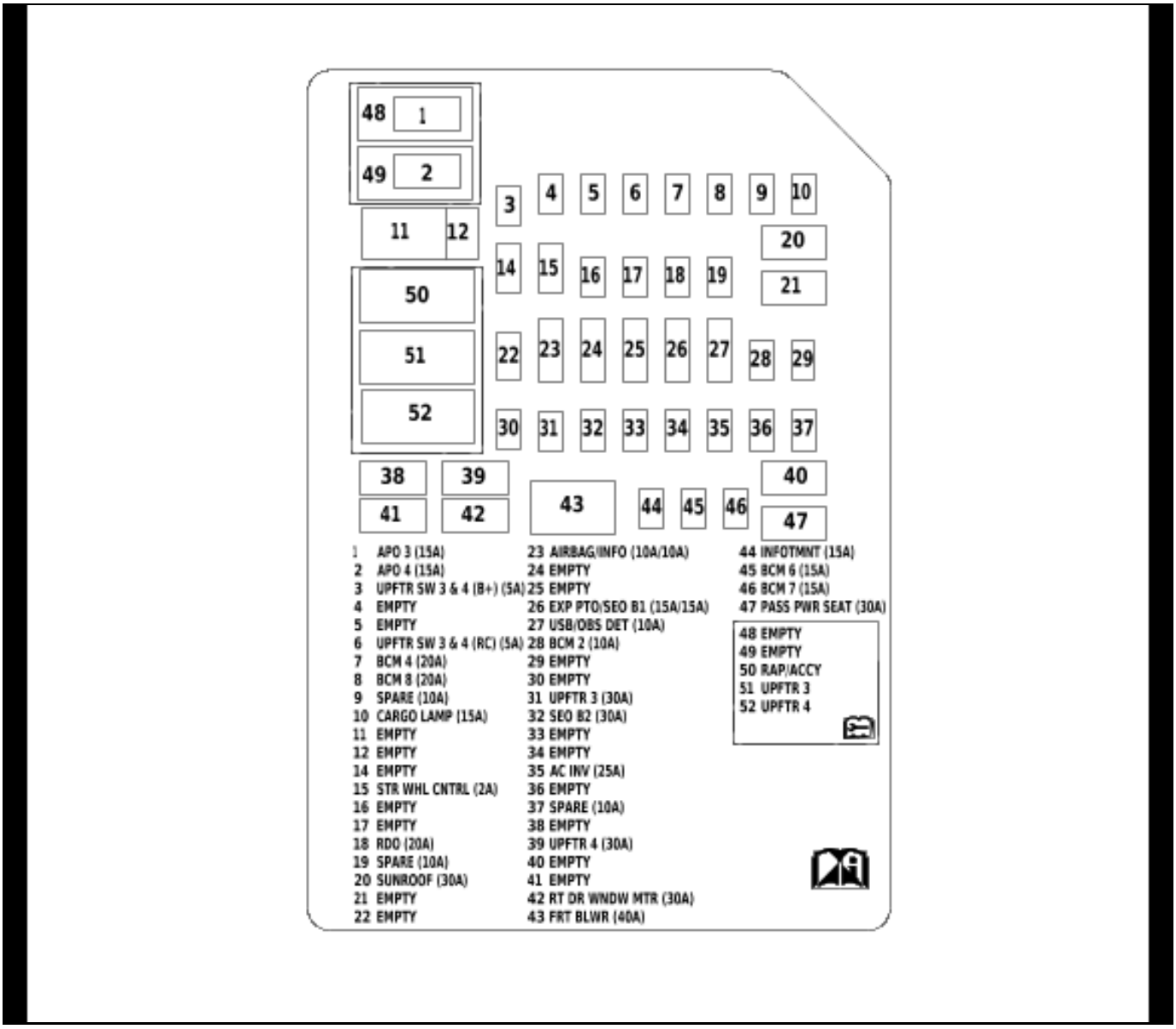
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19368264	J-35616-4A (PU)	J-38125-11A
II	84757974	J-35616-2A (GY)	J-38125-215A

X51L Fuse Block - Instrument Panel Left X3

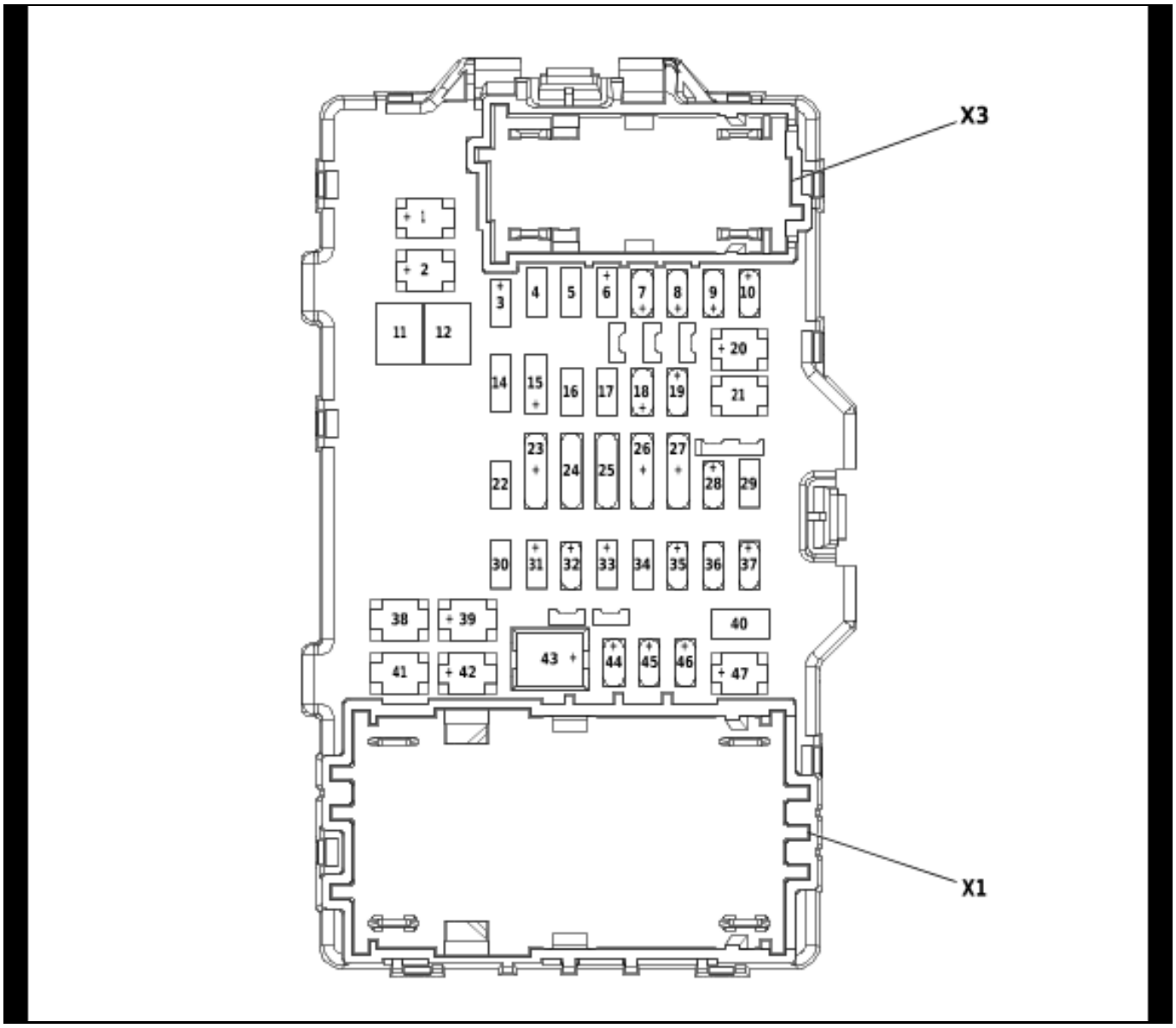
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 11	—	—	—	Not Occupied	—	—
12	0.5	RD / YE	240	Battery Positive Voltage	II	—
13	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	II	—
14	0.35	VT / BK	1139	Run/Crank Ignition 1 Voltage	I	—
15 - 20	—	—	—	Not Occupied	—	—

X51R Fuse Block - Instrument Panel Right Label



4894111

X51R Fuse Block - Instrument Panel Right Top View



4894113

Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	APO 3	F1DR	15A	• X80D Accessory Power Receptacle - Center Console Compartment (D07) • X80E Accessory Power Receptacle - Center Seat (A52-APL)
2	APO 4	F2DR	15A	• X80D Accessory Power Receptacle - Center Console Compartment (AE7/A52-APL) • X80L Accessory Power Receptacle - Center Console Rear (D07)
3	UPFTR SW 3 and 4 (B+)	F3DR	5A	• KR161C Configurable Provision Relay 3 (9L7) • KR161D Configurable Provision Relay 4 (9L7)
4	EMPTY	F4DR	—	• Not Used
5	EMPTY	F5DR	—	• Not Used

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
6	UPFTR SW 3 and 4 (RC)	F6DR	5A	• KR161C Configurable Provision Relay 3 (9L7) • KR161D Configurable Provision Relay 4 (9L7)
7	BCM 4	F7DR	20A	• K9 Body Control Module • E4G Headlamp - Left Low Beam • E4R Park/Turn Signal Lamp - Right Lower • E4T Park/Turn Signal Lamp - Right Upper • E4Z Turn Signal Repeater Lamp - Right (DPN) • KR68R Turn Signal Lamps Relay - Right (5DX/5DY) • X107 Accessory Wiring Harness Package - Snow Plow Tee Left to Snow Plow Headlight - Left (UNL)
8	BCM 8	F8DR	20A	• K9 Body Control Module • A23D Door Latch Assembly - Driver • A23LR Door Latch Assembly - Left Rear (Crew Cab) • A23P Door Latch Assembly - Passenger • A23RR Door Latch Assembly - Right Rear (Crew Cab) • X500 Front Side Door Door Wiring Harness - Driver to Body Wiring Harness • X600 Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness • X700 Rear Side Door Door Wiring Harness - Left to Body Wiring Harness (Crew Cab) • X800 Rear Side Door Door Wiring Harness - Right to Body Wiring Harness (Crew Cab)
9	SPARE	F9DR	10A	• Not Used
10	CARGO LAMP	F10DR	15A	• E6 Center High Mounted Stop Lamp • E33 Cargo Lamp (WRD) • E70D Outside Rearview Mirror Cargo Lamp - Driver (DPN) • E70P Outside Rearview Mirror Cargo Lamp - Passenger (DPN)
11	EMPTY	F11DR	—	• Not Used
12	EMPTY	F12DR	—	• Not Used
14	EMPTY	F14DR	—	• Not Used
15	STR WHL CNTRL	F15DR	2A	• S70L Steering Wheel Controls - Left • S70R Steering Wheel Controls Switch - Right (UK3)
16	EMPTY	F16DR	—	• Not Used
17	EMPTY	F17DR	—	• Not Used
18	RDO	F18DR	20A	• A11 Radio (IO3/IO5) • A33 Media Disc Player (TG5) • K74 Human Machine Interface Control (IO5) • X83 Auxiliary Audio Input (D07) • X92 USB Receptacle (D07)
19	SPARE	F19DR	10A	• Not Used
20	SUNROOF	F20DR	30A	• KR58 Roof Beacon Relay (TRW)
21	EMPTY	F21DR	—	• Not Used
22	EMPTY	F22DR	—	• Not Used
23	AIRBAG/INFO	F23DR	10A/10A	• K36 Inflatable Restraint Sensing and Diagnostic Module • K73 Telematics Communication Interface Control Module (UE1)
24	EMPTY	F24DR	—	• Not Used

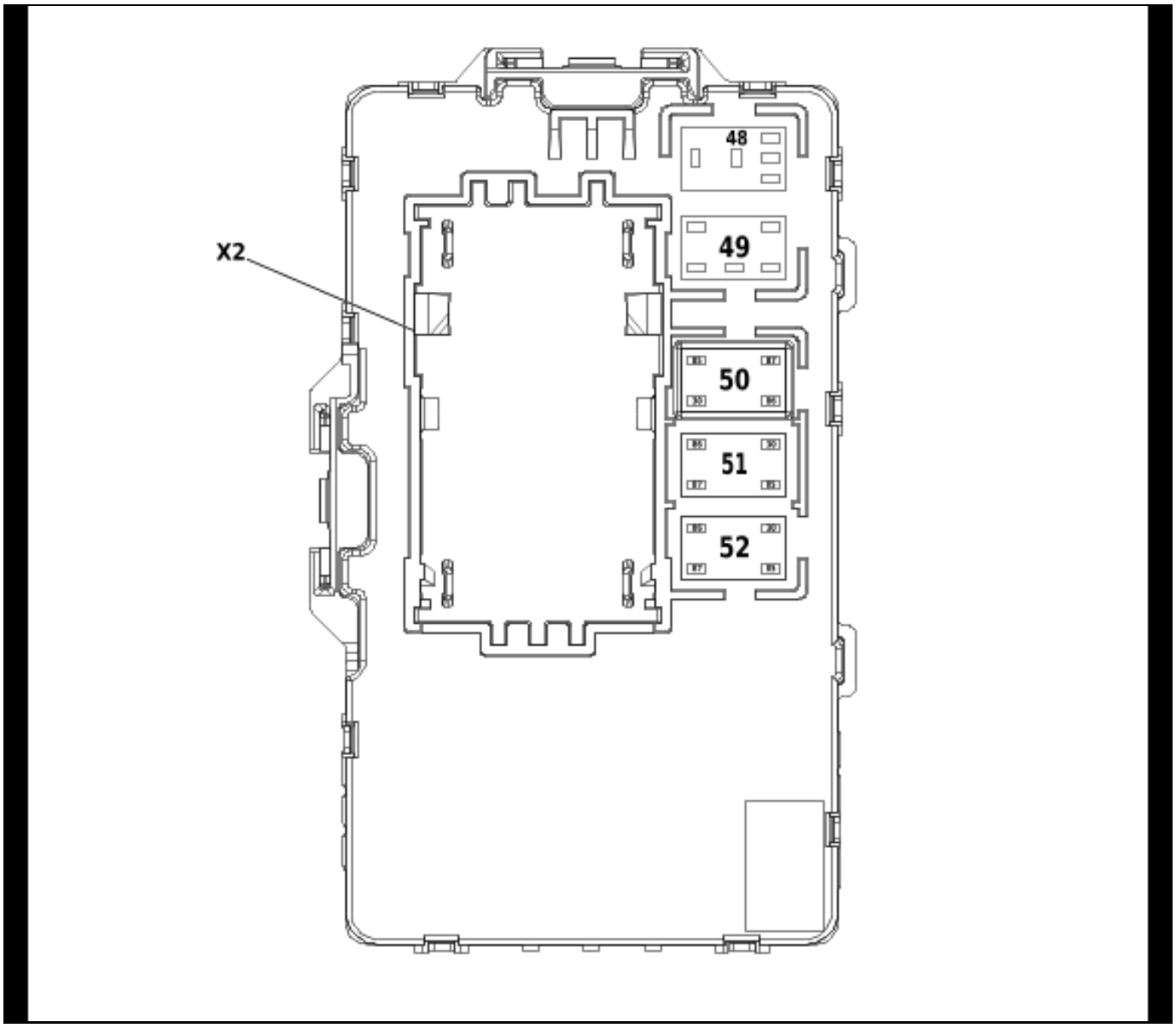
Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
25	EMPTY	F25DR	—	• Not Used
26	EXP PTO/SEO B1	F26DR	15A/15A	• K44 Power Take - Off Control Module (PTO) • X191 Engine Wiring Harness - Chassis to Engine Wiring Harness - Chassis (PTO)
27	USB/OBS DET	F27DR	10A	• X83 Auxiliary Audio Input (-APL/D07)
28	BCM 2	F28DR	10A	• K9 Body Control Module • B10B Ambient Light/Sunload Sensor • K17 Electronic Brake Control Module • K36 Inflatable Restraint Sensing and Diagnostic Module • K44 Power Take-Off Control Module (PTO) • K56 Serial Data Gateway Module • K71 Transmission Control Module • K73 Telematics Communication Interface Control Module (UE1) • K74 Human Machine Interface Control Module (IO5) • K77 Remote Control Door Lock Receiver • K89 Immobilizer Control Module • KR12B Windshield Wiper Relay • S70L Steering Wheel Controls Switch - Left • S77 Transfer Case Shift Control Switch (NQF) • X61A Junction Block - Instrument Panel • X81 Accessory Power Receptacle - 110V AC (KI4)
29	EMPTY	F29DR	—	• Not Used
30	EMPTY	F30DR	—	• Not Used
31	UPFTR 3	F31DR	30A	• X61A Junction Block - Instrument Panel
32	SEO B2	F32DR	30A	• X61A Junction Block - Instrument Panel
33	EMPTY	F33DR	—	• Not Used
34	EMPTY	F34DR	—	• Not Used
35	AC INV	F35DR	25A	• T1 Accessory DC/AC Power Inverter Module (KI4)
36	EMPTY	F36DR	—	• Not Used
37	SPARE	F37DR	10A	• Not Used
38	EMPTY	F38DR	—	• Not Used
39	UPFTR 4	F39DR	30A	• X61A Junction Block-Instrument Panel • KR150 Relay - Spare
40	EMPTY	F40DR	—	• Not Used
41	EMPTY	F41DR	—	• Not Used
42	RT DR WNDW MTR	F42DR	30A	• S79P Window Switch - Passenger (A31) • S79RR window Switch - Right Rear (Crew Cab)
43	FRT BLWR	F43DR	40A	• M8 Blower Motor
44	INFOTMNT	F44DR	15A	• A11 Radio (IOB)

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
45	BCM 6	F45DR	15A	• K9 Body Control Module • E31L Sunshade Mirror Lamp - Left (DH6) • E31R Sunshade Mirror Lamp - Right (DH6) • E37B Dome/Reading Lamps - 2nd Row (Crew Cab) • E37EL Dome/Reading Lamps - Front Overhead Console Left • E37ER Dome/Reading Lamps - Front Overhead Console Right • F14DL • KR76A Retained Accessory Power Relay 1 • KR76B Retained Accessory Power Relay 2 • S5 Center Console Compartment Lamp Switch (D07) • S12 Dome Lamp Switch • S13D Door Lock Switch - Driver • S13P Door Lock Switch - Passenger • S30 Headlamp Switch • S48A Multifunction Switch - Instrument Panel • S52 Outside Rearview Mirror Switch (DPN) • S63 Roof Beacon Switch (TRW) • S76 Trailer Brake Control Switch (JL1) • S77 Transfer Case Shift Control Switch (NQF)
46	BCM 7	F46DR	15A	• K9 Body Control Module • E37B Dome/Reading Lamps - 2nd Row (Crew Cab) • E37EL Dome/Reading Lamps - Front Overhead Console Left • E37ER Dome/Reading Lamps - Front Overhead Console Right • M7 Transmission Shift Lock Control Solenoid Actuator
47	PASS PWR SEAT	F47DR	30A	• S64P Seat Adjuster Switch - Passenger (A95)

X51R Fuse Block - Instrument Panel Right Bottom View



4894114

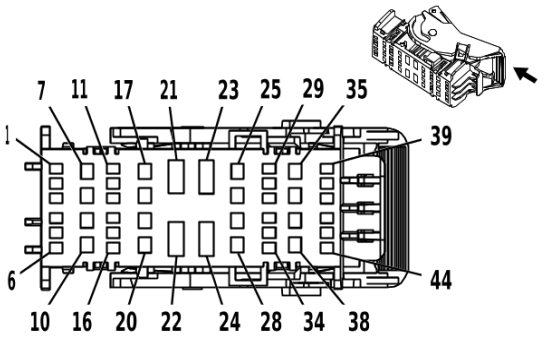
Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Relays				
48	EMPTY	—	—	• Not Used
49	EMPTY	—	—	• Not Used
50	RAP/ACCY	KR76B Retained Accessory Power Relay 2	—	• F1DR • F2DR
51	UPFTR 3	KR161C Configurable Provision Relay 3	—	• F31DR
52	UPFTR 4	KR161D Configurable Provision Relay 4	—	• F39DR

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
Note: Relays listed below are non-serviceable Printed Circuit Board (PCB) relays and are internal to the block.				
—	—	KR112 Cargo Lamp Relay	—	• F10DR
—	—	KR113 Child Security Lock Disable Relay	—	• A23D Door Latch Assembly - Driver • A23LR Door Latch Assembly - Left Rear (Crew Cab) • A23P Door Latch Assembly - Passenger • A23RR Door Latch Assembly - Right Rear (Crew Cab)
—	—	KR114 Door Dead Lock Relay	—	• A23D Door Latch Assembly - Driver • A23LR Door Latch Assembly - Left Rear (Crew Cab) • A23P Door Latch Assembly - Passenger • A23RR Door Latch Assembly - Right Rear (Crew Cab)

X51R Fuse Block - Instrument Panel Right X1



3240121

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 13967689
Service Connector: 19329457
Description: 44-Way F 1.5, 2.8, 800 Metri-Pack Series(NA)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19367554	J-35616-44 (YE)	J-38125-558
III	19368264	J-35616-4A (PU)	J-38125-11A
IV	19370817	J-35616-2A (GY)	J-38125-215A
V	84757974	J-35616-2A (GY)	J-38125-215A

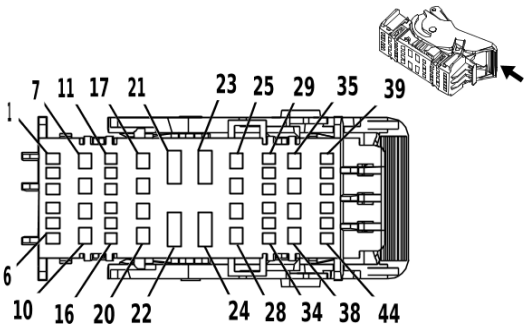
X51R Fuse Block - Instrument Panel Right X1

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	0.75 1.5	GY GY	295 295	Door Lock Actuator Lock Control Door Lock Actuator Lock Control	IV V	CREW CAB STANDARD CAB
2	1.5	WH / BU	3266	Child Security Lock Motor Lock Control	V	—
3	0.35	VT / YE	3267	Child Security Lock Relay Control	V	—
4	1.5	GY / GN	3271	Door Lock Control 2	V	—
5	—	—	—	Not Occupied	—	—
6	0.35	GY / VT	755	Retained Accessory Power Relay Coil Control	V	—
7 - 11	—	—	—	Not Occupied	—	—
12	0.75	RD / BU	4540	Battery Positive Voltage	IV	—
13	0.75	RD / VT	2640	Battery Positive Voltage	IV	—
14	—	—	—	Not Occupied	—	—
15	0.5	VT / GY	709	Left Park Lamp Control	V	—
16	0.5	RD / GN	4440	Battery Positive Voltage	V	—
17	—	—	—	Not Occupied	—	—
18	1.5	VT / YE	143	Accessory Ignition Voltage	III	—
19	2.5	RD / WH	1340	Battery Positive Voltage	III	—
20	2.5	RD / WH	1340	Battery Positive Voltage	III	—

X51R Fuse Block - Instrument Panel Right X1 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
21	6	RD / GN	242	Battery Positive Voltage	II	—
22	4	RD / VT	542	Battery Positive Voltage	II	—
23	—	—	—	Not Occupied	—	—
24	6	RD / GY	142	Battery Positive Voltage	II	—
25 - 26	—	—	—	Not Occupied	—	—
27	0.75	RD / VT	340	Battery Positive Voltage	I	—
28	—	—	—	Not Occupied	—	—
29	1.5	BU / WH	195	Door Lock Control	V	—
30	1.5	BN	5910	Door Dead Lock Actuator Lock Control	V	—
31 - 32	—	—	—	Not Occupied	—	—
33	0.75	RD / WH	3440	Battery Positive Voltage	IV	—
34	0.75	RD / GN	5140	Battery Positive Voltage	IV	—
35 - 37	—	—	—	Not Occupied	—	—
38	2.5	RD / BN	1440	Battery Positive Voltage	III	—
39	—	—	—	Not Occupied	—	—
40	0.75	GY	5911	Door Lock Actuator Lock Control 2	IV	—
41	0.35	BU / BN	7547	Security Lock Relay Control	V	—
42 - 44	—	—	—	Not Occupied	—	—

X51R Fuse Block - Instrument Panel Right X2



3240120

Connector Part Information

Harness Type: Instrument Panel Wiring Harness
OEM Connector: 13967690
Service Connector: 19329458
Description: 44-Way F 1.5, 2.8, 800 Metri-Pack Series(GN)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	13575355	J-35616-44 (YE)	J-38125-558
II	19301761	J-35616-4A (PU)	J-38125-215A
III	19368264	J-35616-4A (PU)	J-38125-11A
IV	19370817	J-35616-2A (GY)	J-38125-215A
V	84757974	J-35616-2A (GY)	J-38125-215A

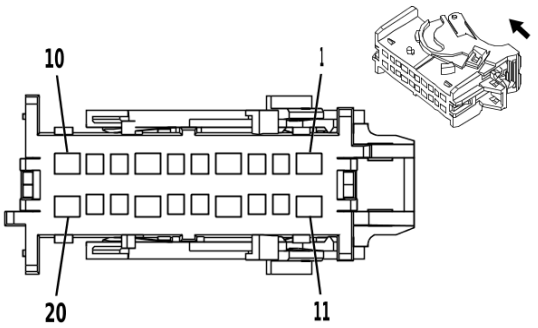
X51R Fuse Block - Instrument Panel Right X2

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 3	—	—	—	Not Occupied	—	—
4	0.5	BN / WH	1429	Standing Lamp Relay Control	V	—
5	0.5	BK	1050	Ground	V	—
6	—	—	—	Not Occupied	—	—
7	0.75	RD / VT	4040	Battery Positive Voltage	II	—
8	0.75	RD / BU	2540	Battery Positive Voltage	II	—
9	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	III	—
10	1.5	VT / YE	243	Accessory Ignition Voltage	III	—
11	0.75	WH / VT	1430	Exterior Courtesy Lamp Control	IV	—
12 - 13	—	—	—	Not Occupied	—	—
14	0.5	GN / GY	963	Configurable Provision Relay 3 Control	V	—
15	0.5	WH / BU	964	Configurable Provision Relay 4 Control	V	—
16	0.35	RD / YE	3040	Battery Positive Voltage	V	—
17	1 0.75	RD / VT RD / VT	340 340	Battery Positive Voltage Battery Positive Voltage	II II	((IO5\IO6)) \((TG5) + (IO3)) (IO3) - (TG5)
18 - 21	—	—	—	Not Occupied	—	—
22	2.5	BK	1050	Ground	I	—

X51R Fuse Block - Instrument Panel Right X2 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
23 - 27	—	—	—	Not Occupied	—	—
28	2.5	RD / GN	968	Configurable Provision 4 Control	III	—
29	0.75	RD / BN	2240	Battery Positive Voltage	IV	—
30 - 33	—	—	—	Not Occupied	—	—
34	0.35	RD / BU	3240	Battery Positive Voltage	V	—
35	2.5	RD / GY	4140	Battery Positive Voltage	III	—
36	—	—	—	Not Occupied	—	—
37	1.5	RD / YE	2340	Battery Positive Voltage	III	—
38	2.5	YE / BN	967	Configurable Provision 3 Control	III	—
39 - 41	—	—	—	Not Occupied	—	—
42	0.75	RD / VT	340	Battery Positive Voltage	IV	—
43 - 44	—	—	—	Not Occupied	—	—

X51R Fuse Block - Instrument Panel Right X3



3243003

Connector Part Information

Harness Type: Roof Wiring Harness
OEM Connector: 15547107
Service Connector: 13597269
Description: 20-Way F 1.5, 2.8 OCS Series(GY)

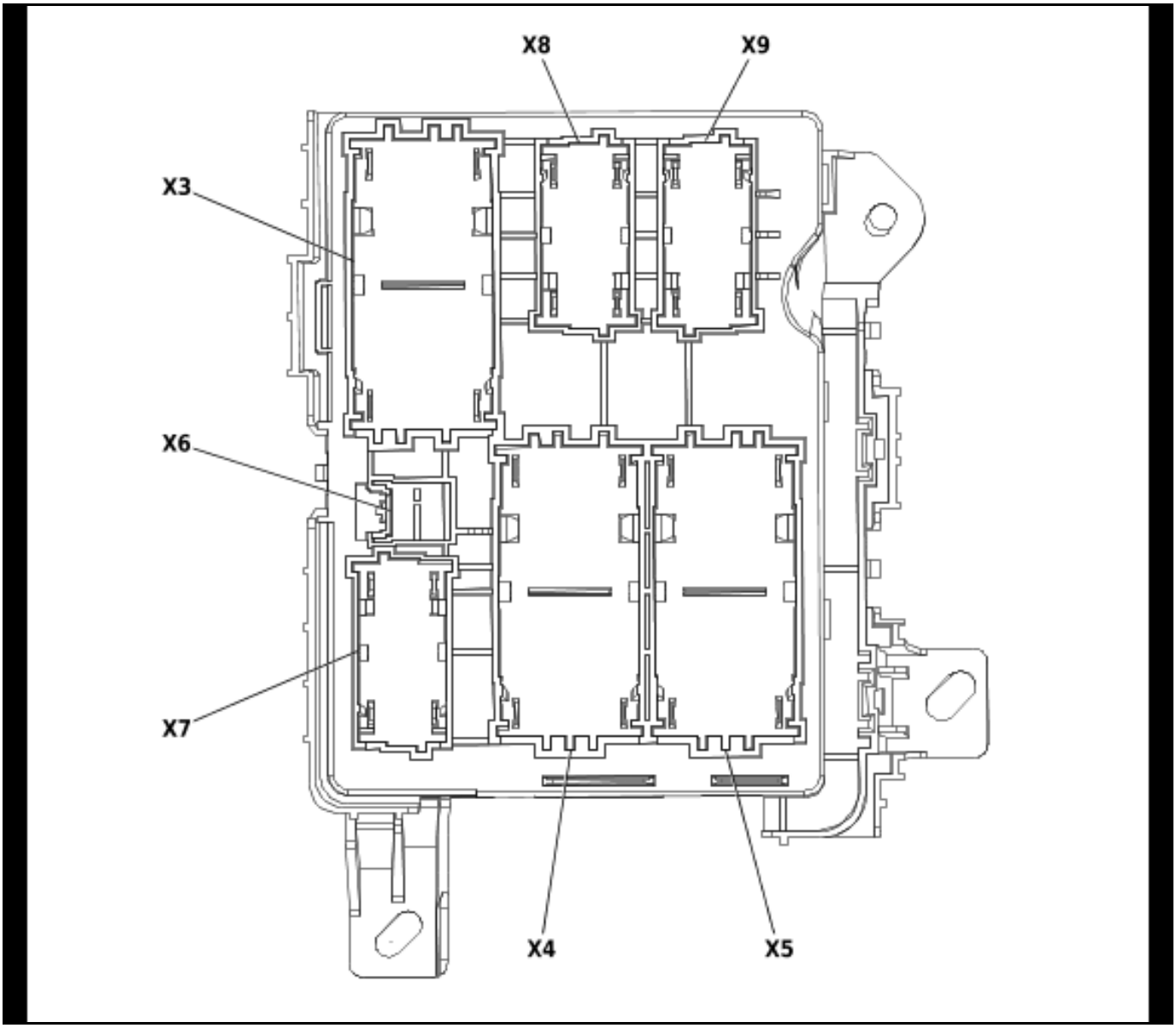
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301752	J-35616-35 (VT)	J-38125-215A
II	84757974	J-35616-2A (GY)	J-38125-215A

X51R Fuse Block - Instrument Panel Right X3

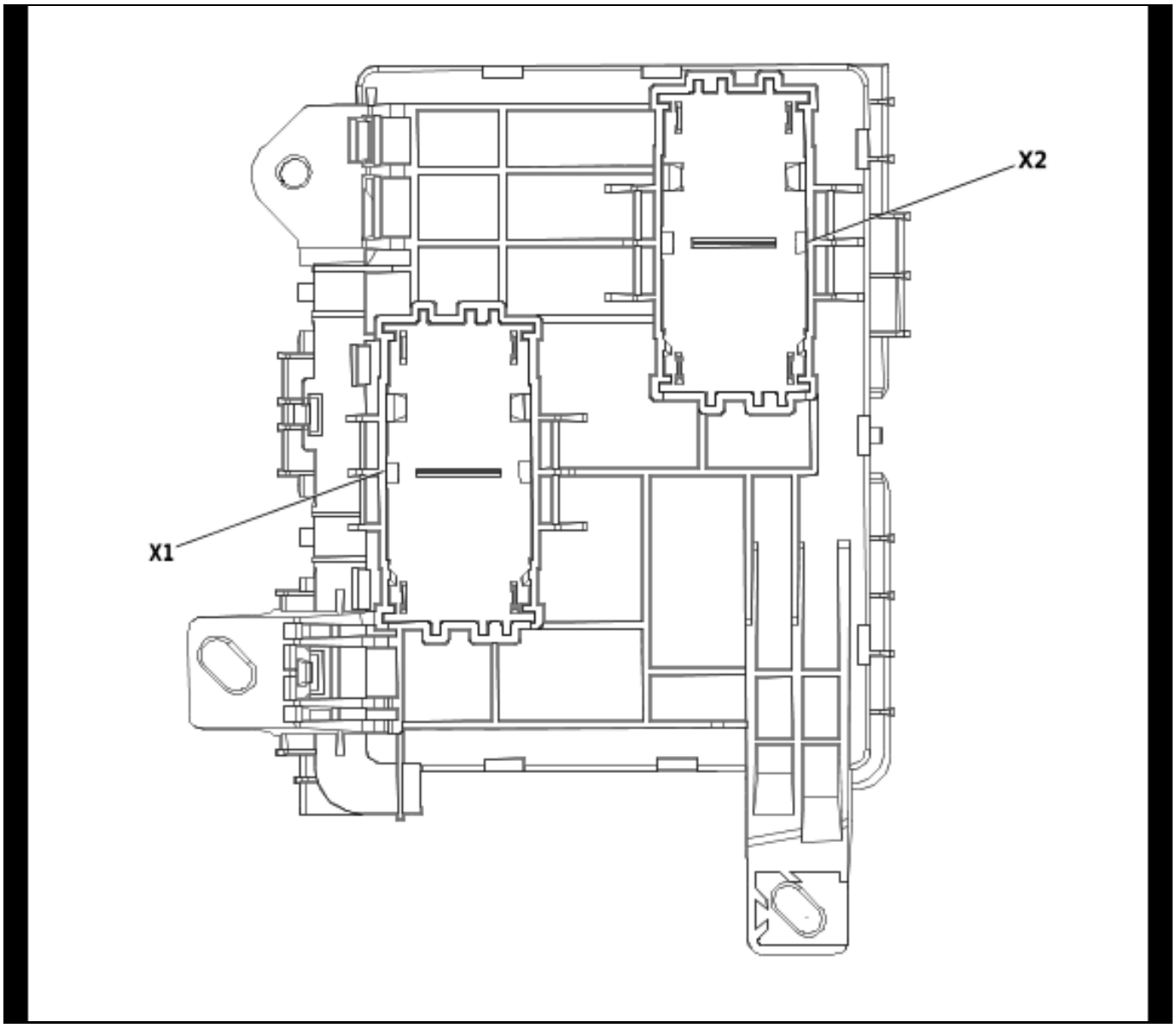
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	2.5	RD / GN	3140	Battery Positive Voltage	I	—
2 - 7	—	—	—	Not Occupied	—	—
8	0.5	VT / GY	709	Left Park Lamp Control	II	—
9	—	—	—	Not Occupied	—	—
10	0.5 2.5	BK BK	1050 1050	Ground Ground	I	— —
11 - 20	—	—	—	Not Occupied	—	—

X61A Junction Block - Instrument Panel Top View



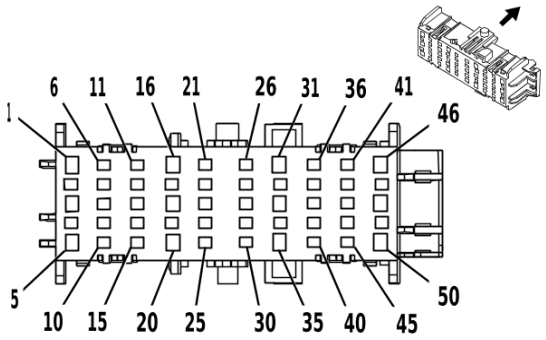
4894115

X61A Junction Block - Instrument Panel Bottom View



4894116

X61A Junction Block - Instrument Panel X1



3240131

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33114819
Service Connector: 19301798
Description: 50-Way F 1.5, 2.8 OCS Series(BK)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19368264	J-35616-4A (PU)	J-38125-11A
II	19370817	J-35616-2A (GY)	J-38125-215A
III	84757974	J-35616-2A (GY)	J-38125-215A

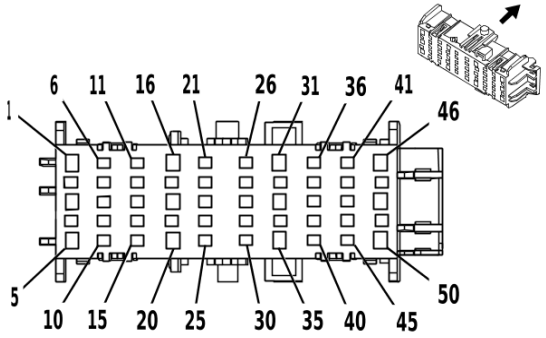
X61A Junction Block - Instrument Panel X1

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 12	—	—	—	Not Occupied	—	—
13	2	RD / GN	968	Configurable Provision 4 Control	III	—
14 - 15	—	—	—	Not Occupied	—	—
16	2.5	BU	965	Configurable Provision 1 Control	I	—
17	0.75	WH / VT	1430	Exterior Courtesy Lamp Control	II	—
18	0.5	BU / YE	6105	High Speed GMLAN Serial Data [+] 2	I	—
19	0.5	BU / YE	6105	High Speed GMLAN Serial Data [+] 2	III	—
20	0.5	WH	6106	High Speed GMLAN Serial Data [-] 2	I	—
21	0.5	RD / WH	961	Configurable Provision Relay 1 Control	III	—
22	0.5	VT	185	Low Washer Fluid Indicator Control	III	—
23	0.35	BN / YE	780	Driver Door Lock Switch Lock Signal	III	—
24	0.5	BN	7634	Trailer Brake Control Redundant Manual Apply Signal	III	—
25	0.35	GY	5697	Child Security Lock Indicator Control	III	—
26	0.5	BU / RD	7632	Trailer Brake Control Switch 5V Reference	III	—
27	0.5	BK / BN	7631	Trailer Brake Control Switch Low Reference	III	—
28	0.35	BN / WH	781	Driver Door Lock Switch Unlock Signal	III	—
29	0.5	YE	7635	Trailer Brake Control Manual Apply Signal	III	—
30	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	III	—
31	—	—	—	Not Occupied	—	—

X61A Junction Block - Instrument Panel X1 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
32	0.5	WH	6106	High Speed GMLAN Serial Data [-] 2	III	—
33	0.35	VT / BN	300	Run Ignition 3 Voltage	I	—
34	0.5	YE / WH	962	Configurable Provision Relay 2 Control	III	—
35	0.5	VT / GN	39	Run/Crank Ignition 1 Voltage	I	—
36	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	III	—
37 - 38	—	—	—	Not Occupied	—	—
39	1	BU / VT	1134	Park Brake Switch Signal	II	—
40	—	—	—	Not Occupied	—	—
41	0.5	GN / BK	7633	Trailer Brake Control User Gain Signal	III	—
42 - 43	—	—	—	Not Occupied	—	—
44	0.5	WH / BU	3691	Trailer Brake Apply Signal	III	—
45	—	—	—	Not Occupied	—	—
46	0.5	VT / WH	1939	Run/Crank Ignition 1 Voltage	I	—
47	0.5	WH	6816	Indicator Dimming Control	III	—
48	—	—	—	Not Occupied	—	—
49	0.35	YE / WH	816	Brake Transmission Shift Interlock Solenoid Actuator Control	III	—
50	2.5	BK	2550	Ground	I	—

X61A Junction Block - Instrument Panel X2



3240130

Connector Part Information

Harness Type: Body Wiring Harness
OEM Connector: 33115109
Service Connector: 19329464
Description: 50-Way F 1.5, 2.8 OCS Series(GY)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19368264	J-35616-4A (PU)	J-38125-11A
III	19368307	J-35616-35 (VT)	J-38125-12A
IV	19370817	J-35616-2A (GY)	J-38125-215A
V	84757974	J-35616-2A (GY)	J-38125-215A

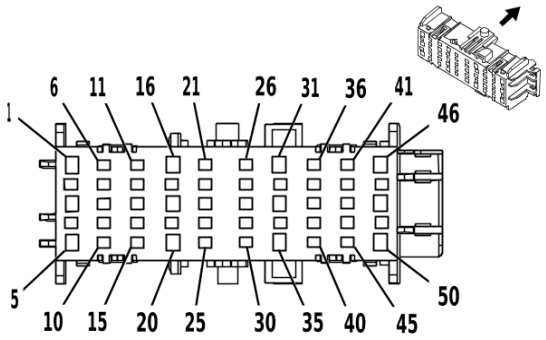
X61A Junction Block - Instrument Panel X2

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 2	—	—	—	Not Occupied	—	—
3	2	RD / GY	1342	Battery Positive Voltage	II	—
4	0.35	BU	2307	Passenger Air Bag On Indicator Control	V	—
5	—	—	—	Not Occupied	—	—
6	0.5	WH	2501	High Speed GMLAN Serial Data [-] 1	V	—
7	0.5	BU	2500	High Speed GMLAN Serial Data [+] 1	V	—
8 - 14	—	—	—	Not Occupied	—	—
15	0.5	GN / WH	24	Backup Lamp Control	V	—
16 - 17	—	—	—	Not Occupied	—	—
18	4	BK	550	Ground	III	—
19	0.35	VT / WH	5234	Passenger Seat Belt Indicator Control	V	—
20 - 22	—	—	—	Not Occupied	—	—
23	0.5 0.75	WH / BN WH / BN	6815 6815	Inadvertent Load Control Inadvertent Load Control	IV	— —
24	0.35	GN	2308	Passenger Air Bag Off Indicator Control	V	—
25	—	—	—	Not Occupied	—	—
26	0.35	BU / GY	7473	Incremental Encoder Impulse Signal	V	—
27	0.35	VT	7476	Incremental Encoder Sensor Low Reference	V	—

X61A Junction Block - Instrument Panel X2 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
28	—	—	—	Not Occupied	—	—
29	0.75	GY	157	Interior Lamp Control	IV	—
30	0.35	GY	156	Courtesy Lamp Switch Signal	V	—
31	1	YE / VT	1553	Transfer Case Motor Counter Clockwise Control	I	—
32	0.35	YE	7474	Incremental Encoder Direction Signal	V	—
33	0.75	VT / GY	1054	Stop Lamp Control	I	—
34	—	—	—	Not Occupied	—	—
35	2.5	RD / GN	242	Battery Positive Voltage	II	—
36	0.35	WH / GN	7475	Incremental Encoder Sensor 8V Reference	V	—
37	—	—	—	Not Occupied	—	—
38	0.35	VT / YE	5985	Accessory Wake-Up Serial Data	V	—
39 - 43	—	—	—	Not Occupied	—	—
44	0.5	WH / BU	3691	Trailer Brake Apply Signal	V	—
45	—	—	—	Not Occupied	—	—
46	1	YE / GY	1552	Transfer Case Motor Clockwise Control	I	—
47	0.5	GN / GY	817	Vehicle Speed Signal	V	—
48	2.5	BU	47	Trailer Auxiliary Control	II	—
49	—	—	—	Not Occupied	—	—
50	0.35	VT / YE	43	Accessory Ignition Voltage	I	—

X61A Junction Block - Instrument Panel X3



3240132

Connector Part Information

Harness Type: Headlining Trim Panel Harness
OEM Connector: 33115112
Service Connector: 19329467
Description: 50-Way F 1.5, 2.8 OCS Series(BU)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	13575742	J-35616-64B (L-BU)	J-38125-215A
II	19368264	J-35616-4A (PU)	J-38125-11A
III	19370817	J-35616-2A (GY)	J-38125-215A
IV	84757974	J-35616-2A (GY)	J-38125-215A

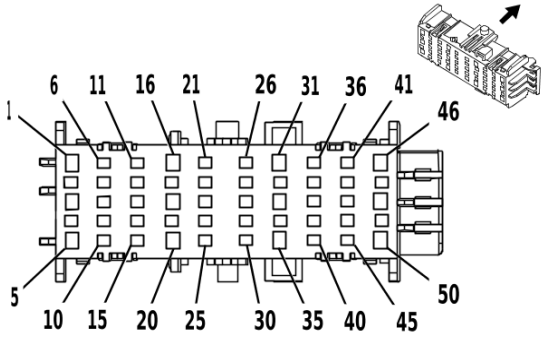
X61A Junction Block - Instrument Panel X3

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 3	—	—	—	Not Occupied	—	—
4	0.35	BU	2307	Passenger Air Bag On Indicator Control	IV	—
5 - 6	—	—	—	Not Occupied	—	—
7	0.75	WH / VT	1430	Exterior Courtesy Lamp Control	III	—
8	0.35	YE / WH	1690	Mirror Dimming Signal	I	—
9	0.35	BK / YE	1691	Automatic Day/Night Mirror Low Reference	I	—
10 - 12	—	—	—	Not Occupied	—	—
13	0.35	GN / RD	24	Backup Lamp Control	IV	—
14 - 16	—	—	—	Not Occupied	—	—
17	0.35	GN / BK	2515	Telematics Switch Supply Voltage	IV	—
18	—	—	—	Not Occupied	—	—
19	0.35	VT / WH	5234	Passenger Seat Belt Indicator Control	IV	—
20	—	—	—	Not Occupied	—	—
21	0.35	GN / BU	2514	Telematics Switch Signal	IV	—
22	0.35	YE / BN	2516	Telematics Switch Green LED Indicator Control	IV	—
23	—	—	—	Not Occupied	—	—
24	0.35	GN / RD	2308	Passenger Air Bag Off Indicator Control	IV	—
25	0.5	WH / BN	6815	Inadvertent Load Control	IV	—
26	—	—	—	Not Occupied	—	—

X61A Junction Block - Instrument Panel X3 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
27	0.5	YE	6817	LED Backlight Dimming Control 1	IV	—
28	0.35	GY / BU	156	Courtesy Lamp Switch Signal	IV	—
29	0.5	GY	157	Interior Lamp Control	IV	—
30 - 34	—	—	—	Not Occupied	—	—
35	0.5	VT / GY	1054	Stop Lamp Control	II	—
36	0.35	BN / WH	2517	Telematics Switch Red LED Indicator Control	IV	—
37 - 40	—	—	—	Not Occupied	—	—
41	0.35	GY / GN	328	Interior Lamp Defeat Switch Signal	IV	—
42	0.35	VT / GN	7558	Front Footwell Accent Lighting Control	IV	—
43 - 45	—	—	—	Not Occupied	—	—
46	2.5	BK	1050	Ground	II	—
47 - 50	—	—	—	Not Occupied	—	—

X61A Junction Block - Instrument Panel X4



3240129

Connector Part Information

Harness Type: Instrument Panel Wiring Harness
OEM Connector: 33115111
Service Connector: 19329466
Description: 50-Way F 1.5, 2.8 OCS Series(GN)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19368264	J-35616-4A (PU)	J-38125-11A
III	19370817	J-35616-2A (GY)	J-38125-215A
IV	84757974	J-35616-2A (GY)	J-38125-215A

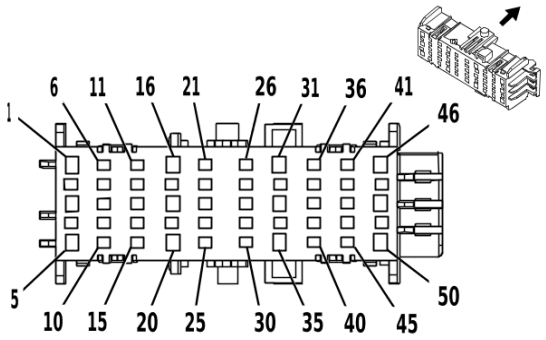
X61A Junction Block - Instrument Panel X4

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	2.5	YE / BN	967	Configurable Provision 3 Control	II	—
2	0.35	YE / VT	2516	Telematics Switch Green LED Indicator Control	IV	—
3	0.35	BK / GN	552	Sensor Low Reference	II	—
4	0.5	WH	2501	High Speed GMLAN Serial Data [-] 1	IV	—
5	0.5	BU	2500	High Speed GMLAN Serial Data [+] 1	II	—
6	0.5	YE	6817	LED Backlight Dimming Control 1	IV	—
7	0.35	GN / WH	2514	Telematics Switch Signal	IV	—
8	0.35	GY / RD	598	5V Reference	IV	—
9	0.35	WH / GN	526	Stop Lamp Switch Signal 2	IV	—
10	0.35	BU / YE	1693	Four Wheel Drive Switch Signal	IV	—
11	—	—	—	Not Occupied	—	—
12	2	RD / GN	968	Configurable Provision 4 Control	IV	—
13	—	—	—	Not Occupied	—	—
14	0.35	BN	1560	Neutral Indicator Control	IV	—
15	0.35	GY / RD	6029	Four Wheel Drive Mode Switch 5V Reference	IV	—
16	2.5	BK	1050	Ground	II	—
17	—	—	—	Not Occupied	—	—
18	2.5	GY / BK	966	Configurable Provision 2 Control	II	—
19	0.35	GN / BK	2515	Telematics Switch Supply Voltage	IV	—

X61A Junction Block - Instrument Panel X4 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
20	2.5	RD / GN	968	Configurable Provision 4 Control	II	—
21	0.5	VT / GN	7558	Front Footwell Accent Lighting Control	IV	—
22	0.35	BN / WH	2517	Telematics Switch Red LED Indicator Control	IV	—
23	0.35	BN / BK	1566	4WD HI Indicator Control	IV	—
24	0.35	VT / WH	1565	4WD LO Indicator Control	IV	—
25	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	IV	—
26	—	—	—	Not Occupied	—	—
27	0.35	GY / GN	328	Interior Lamp Defeat Switch Signal	IV	—
28 - 30	—	—	—	Not Occupied	—	—
31	1.5	RD / YE	2340	Battery Positive Voltage	II	—
32	0.5	BK / WH	1851	Signal Ground	IV	—
33	0.35 0.5	BK / WH BK / WH	1851 1851	Signal Ground Signal Ground	I	— —
34	—	—	—	Not Occupied	—	—
35	2.5	BK / WH	1851	Signal Ground	II	—
36 - 37	—	—	—	Not Occupied	—	—
38	0.5	BK / WH	1851	Signal Ground	IV	—
39	0.35	BK / WH	1851	Signal Ground	IV	—
40	0.35	GN / BK	1563	2WD HI Indicator Control	IV	—
41 - 43	—	—	—	Not Occupied	—	—
44	0.75	BK	2550	Ground	III	—
45	0.35	BK	2550	Ground	IV	—
46	0.75	BK	2550	Ground	I	—
47	0.35 0.35	BK BK	2550 2550	Ground Ground	III IV	IO3/ IO5 IOB
48	0.75	BK	2550	Ground	I	—
49	—	—	—	Not Occupied	—	—
50	0.75	BK	2550	Ground	I	—

X61A Junction Block - Instrument Panel X5



3240128

Connector Part Information

Harness Type: Instrument Panel Wiring Harness
OEM Connector: 33115110
Service Connector: 19329465
Description: 50-Way F 1.5, 2.8 OCS Series(NA)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	19301761	J-35616-4A (PU)	J-38125-215A
II	19368264	J-35616-4A (PU)	J-38125-11A
III	19370817	J-35616-2A (GY)	J-38125-215A
IV	84757974	J-35616-2A (GY)	J-38125-215A

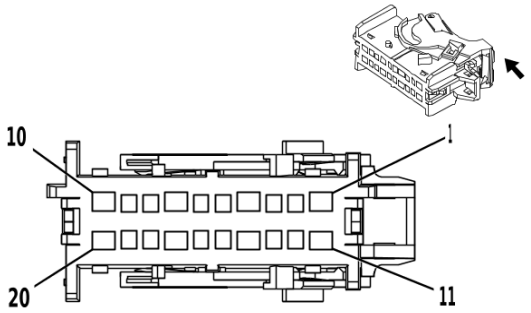
X61A Junction Block - Instrument Panel X5

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	0.5	WH	6106	High Speed GMLAN Serial Data [-] 2	II	—
2	0.5	BU / YE	6105	High Speed GMLAN Serial Data [+] 2	IV	—
3	0.5	BU / YE	6105	High Speed GMLAN Serial Data [+] 2	II	—
4	0.75	WH / VT	1430	Exterior Courtesy Lamp Control	III	—
5	—	—	—	Not Occupied	—	—
6	0.35	GY	5697	Child Security Lock Indicator Control	IV	—
7	0.5	BN	7634	Trailer Brake Control Redundant Manual Apply Signal	IV	—
8	0.35	BN / YE	780	Driver Door Lock Switch Lock Signal	IV	—
9	0.35	VT	185	Low Washer Fluid Indicator Control	IV	—
10	0.5	RD / WH	961	Configurable Provision Relay 1 Control	IV	—
11	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	IV	—
12	0.5	YE	7635	Trailer Brake Control Manual Apply Signal	IV	—
13	0.35	BN / WH	781	Driver Door Lock Switch Unlock Signal	IV	—
14	0.5	BK / BN	7631	Trailer Brake Control Switch Low Reference	IV	—
15	0.5	BU / RD	7632	Trailer Brake Control Switch 5V Reference	IV	—
16	0.5	VT / GN	39	Run/Crank Ignition 1 Voltage	II	—
17	0.5	YE / WH	962	Configurable Provision Relay 2 Control	IV	—

X61A Junction Block - Instrument Panel X5 (cont'd)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
18	0.35	VT / BN	300	Run Ignition 3 Voltage	I	KI4
	0.35	VT / BN	300	Run Ignition 3 Voltage	II	- KI4
19	0.5	WH	6106	High Speed GMLAN Serial Data [-] 2	IV	—
20 - 21	—	—	—	Not Occupied	—	—
22	0.5	BU / VT	1134	Park Brake Switch Signal	IV	—
23 - 24	—	—	—	Not Occupied	—	—
25	0.5	VT / WH	239	Run/Crank Ignition 1 Voltage	IV	—
26	—	—	—	Not Occupied	—	—
27	0.5	WH / BU	3691	Trailer Brake Apply Signal	IV	—
28 - 29	—	—	—	Not Occupied	—	—
30	0.5	GN / BK	7633	Trailer Brake Control User Gain Signal	IV	—
31	0.35	BK	2550	Ground	II	—
32	0.35	YE / WH	816	Brake Transmission Shift Interlock Solenoid Actuator Control	IV	—
33	—	—	—	Not Occupied	—	—
34	0.5	WH	6816	Indicator Dimming Control	IV	—
35 - 36	—	—	—	Not Occupied	—	—
37	0.35	WH	6816	Indicator Dimming Control	IV	—
38	0.35	WH	6816	Indicator Dimming Control	IV	—
39 - 50	—	—	—	Not Occupied	—	—

X61A Junction Block - Instrument Panel X8



3240104

Connector Part Information

Harness Type: Auxiliary Fuse Block Wiring Harness
OEM Connector: 15547106
Service Connector: Service by Harness - See Part Catalog
Description: 20-Way F 1.5, 2.8 OCS Series(BK)

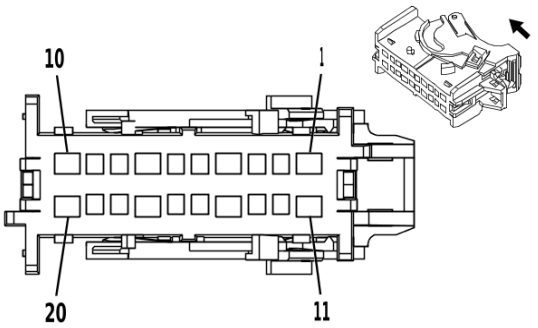
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-14 (GN)	No Tool Required
II	Not required	J-35616-2A (GY)	No Tool Required
III	Not required	J-35616-4A (PU)	No Tool Required

X61A Junction Block - Instrument Panel X8

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1 - 7	—	—	—	Not Occupied	—	—
8	0.5	WH / GN	526	Stop Lamp Switch Signal 2	II	—
9	0.5	WH	2501	High Speed GMLAN Serial Data [-] 1	II	—
10	0.5	BU	2500	High Speed GMLAN Serial Data [+] 1	III	—
11	—	—	—	Not Occupied	—	—
12	0.5	WH	2501	High Speed GMLAN Serial Data [-] 1	II	—
13	0.5	BU	2500	High Speed GMLAN Serial Data [+] 1	II	—
14 - 15	—	—	—	Not Occupied	—	—
16	1.5	YE	5129	Not Used	I	- NQF
17	—	—	—	Not Occupied	—	—
18	1.5	GN / VT	5130	Not Used	I	- NQF
19	0.5	BK / GN	552	Sensor Low Reference	II	—
20	0.5	GY / RD	598	5V Reference	III	—

X61A Junction Block - Instrument Panel X9 (NQF)



3243003

Connector Part Information

Harness Type: Auxiliary Fuse Block Wiring Harness
OEM Connector: 15547107
Service Connector: Service by Harness - See Part Catalog
Description: 20-Way F 1.5, 2.8 OCS Series(GY)

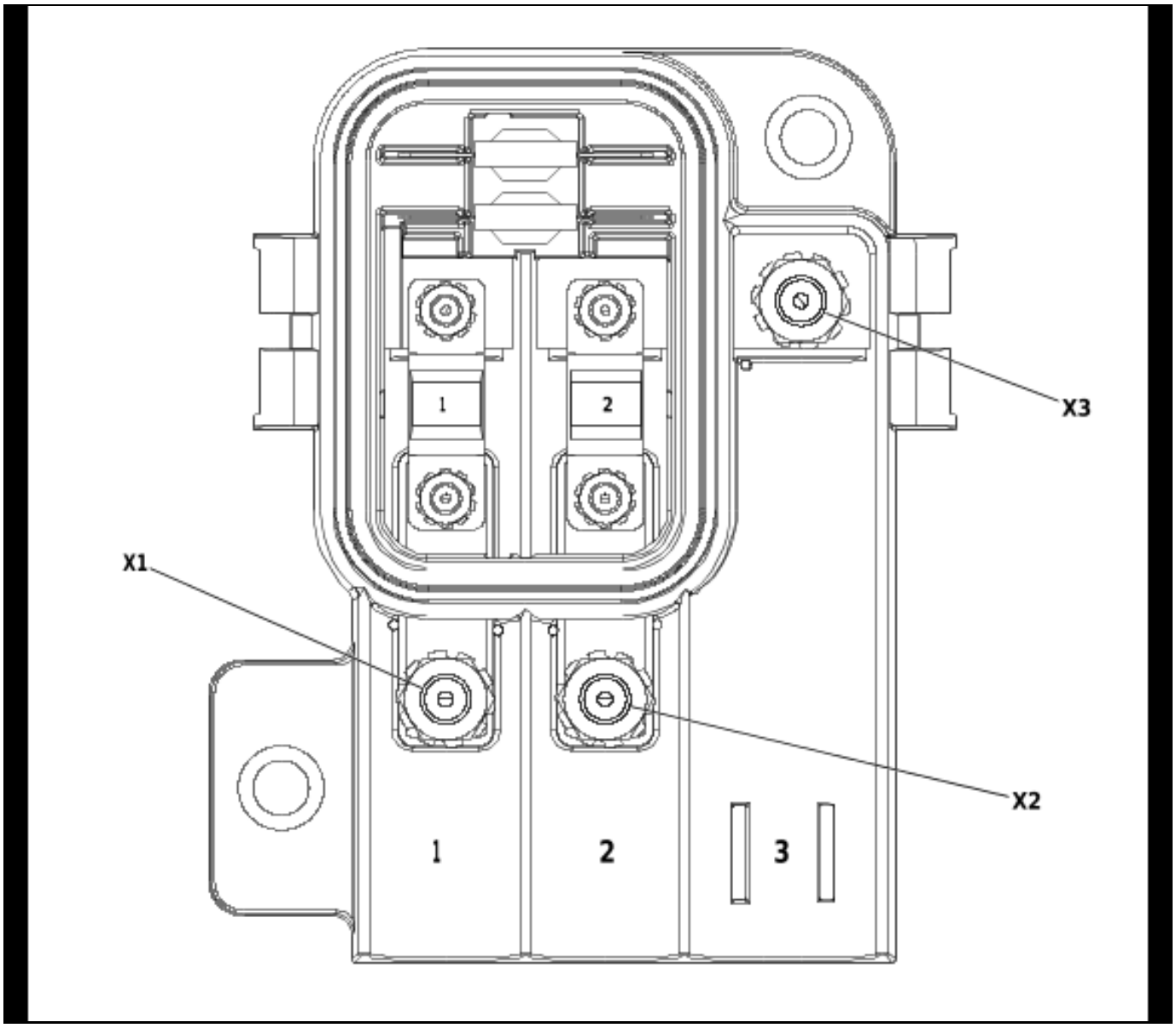
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-2A (GY)	No Tool Required
II	Not required	J-35616-35 (VT)	No Tool Required
III	Not required	J-35616-4A (PU)	No Tool Required

X61A Junction Block - Instrument Panel X9 (NQF)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
1	—	—	—	Not Occupied	—	—
2	0.35	BU / YE	1693	Four Wheel Drive Switch Signal	I	—
3	0.35	GY / RD	6029	Four Wheel Drive Mode Switch 5V Reference	I	—
4	0.35	BN / BK	1566	4WD HI Indicator Control	III	—
5	0.35	VT / WH	1565	4WD LO Indicator Control	I	—
6	0.35	VT / GN	1739	Run/Crank Ignition 1 Voltage	I	—
7	0.35	VT / YE	5985	Accessory Wake-Up Serial Data	III	—
8	0.35	GN / BK	1563	2WD HI Indicator Control	I	—
9 - 10	—	—	—	Not Occupied	—	—
11	3	RD / GY	1342	Battery Positive Voltage	II	—
12	0.35	BN	1560	Neutral Indicator Control	I	—
13	0.35	VT	7476	Incremental Encoder Sensor Low Reference	I	—
14	3	BK	550	Ground	II	—
15	0.35	BU / GY	7473	Incremental Encoder Impulse Signal	I	—
16	0.35	YE	7474	Incremental Encoder Direction Signal	I	—
17	1	YE / VT	1553	Transfer Case Motor Counter Clockwise Control	III	—
18	0.35	WH / GN	7475	Incremental Encoder Sensor 8V Reference	I	—
19	—	—	—	Not Occupied	—	—
20	1	YE / GY	1552	Transfer Case Motor Clockwise Control	III	—

X50E Fuse Block - Battery Auxiliary Top View (UEH)

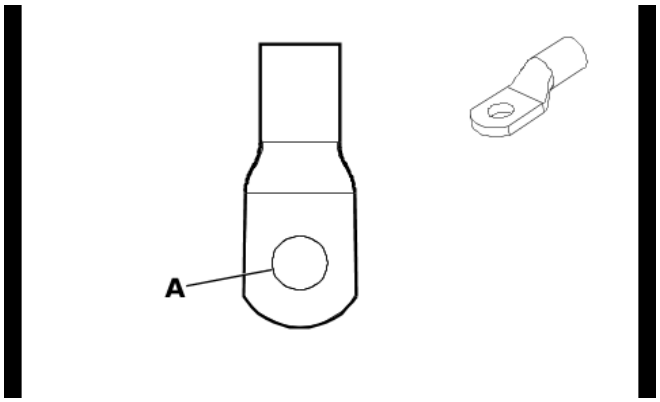


5335626

Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	—	F1BB	100A	• F4PA • F5PA • F6PA • F7PA
2	—	F2BB	100A	• F1PA • F2PA • F3PA • F8PA

X50E Fuse Block - Battery Auxiliary X1 (UEH)



5480255

Connector Part Information

Harness Type: Accessory Power Fuse Block Rear Wiring Harness
OEM Connector: 2241627C1
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

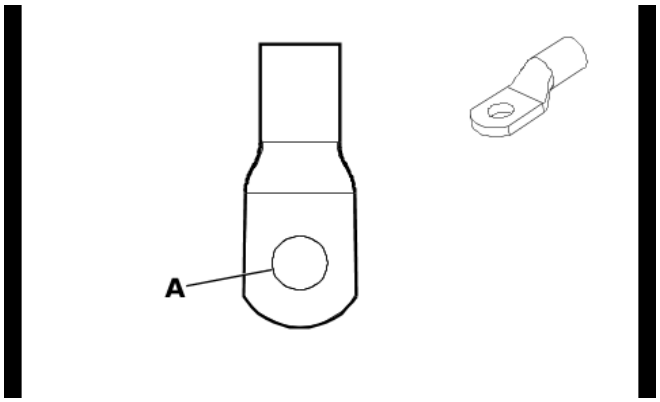
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50E Fuse Block - Battery Auxiliary X1 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	21.2	RD	1A	Battery Positive Voltage	I	—

X50E Fuse Block - Battery Auxiliary X2 (UEH)



5480255

Connector Part Information

Harness Type: Accessory Power Fuse Block Rear Wiring Harness
OEM Connector: 2241627C1
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

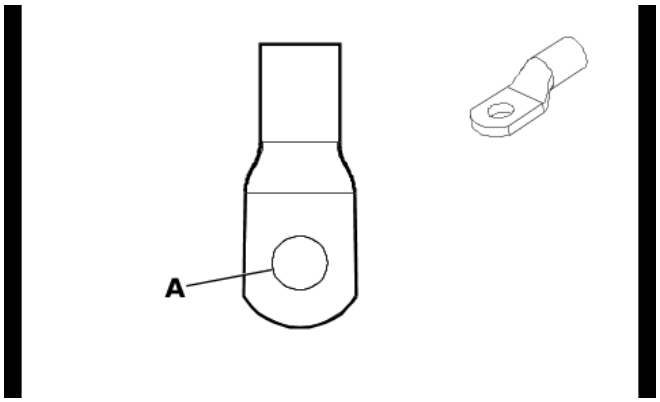
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50E Fuse Block - Battery Auxiliary X2 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	21.2	RD	1B	Battery Positive Voltage	I	—

X50E Fuse Block - Battery Auxiliary X3 (UEH)



5480255

Connector Part Information

Harness Type: Auxiliary Battery Positive Cable - Cab
OEM Connector: 2241353C1
Service Connector: Service by Cable Assembly — See Part Catalog
Description: 1-Way Ring Terminal

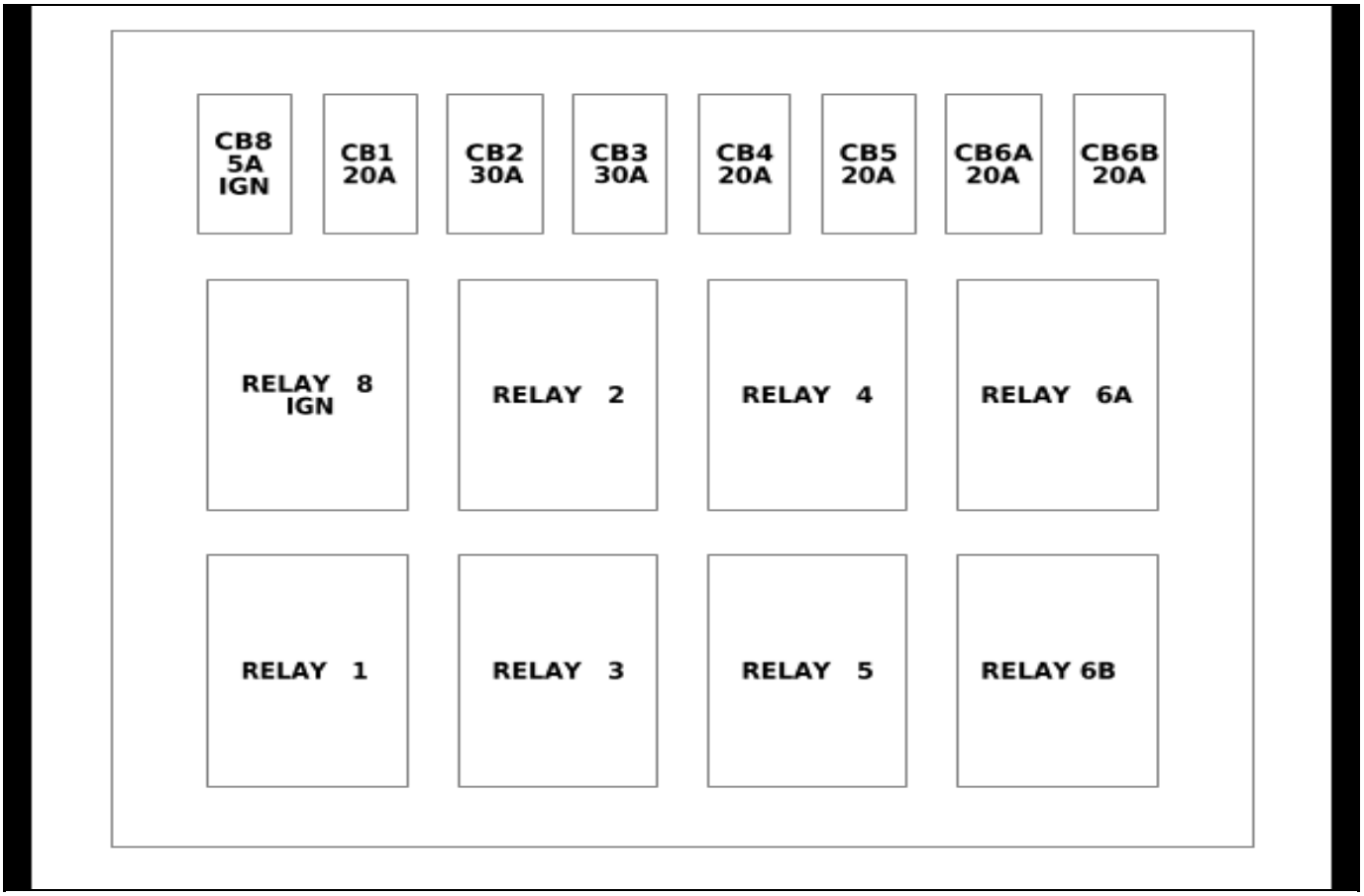
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	No Tool Required	No Tool Required

X50E Fuse Block - Battery Auxiliary X3 (UEH)

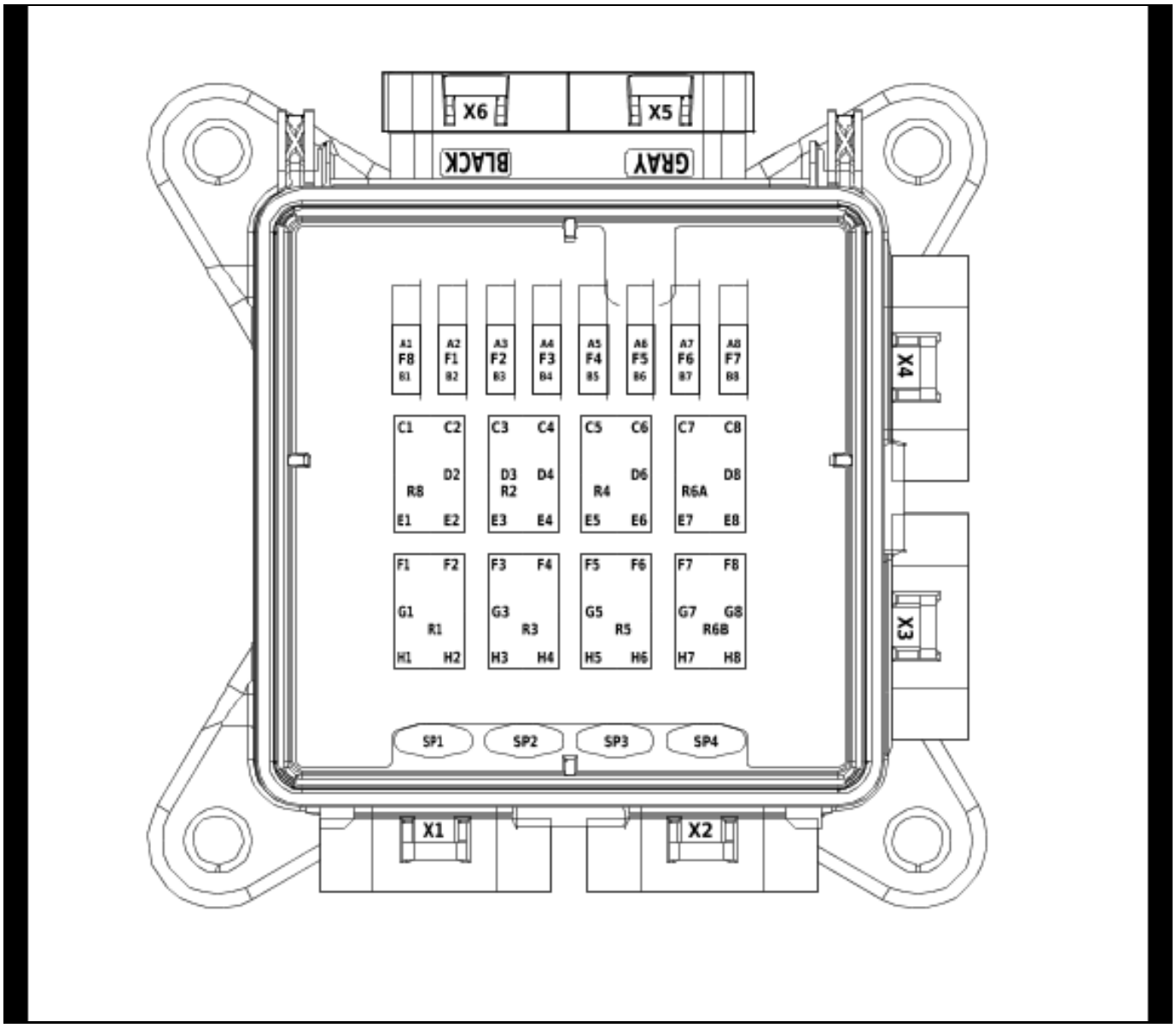
Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	33.6	RD	A	Unfused Battery Positive Voltage	I	—

X54G Fuse Block - Body Provision Label (UEH)



5335627

X54G Fuse Block - Body Provision Top View (UEH)



5335628

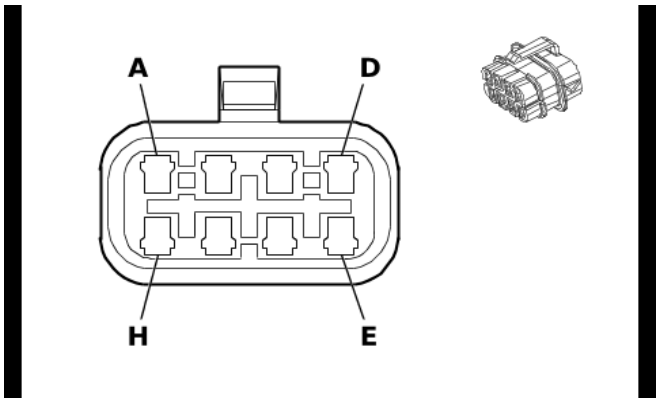
Usage Table

No.	Device Label Name	Device Assigned Name	Rating	Description
Fuses				
1	CB1	F1PA	20A	• KR161E Configurable Provision Relay 5
2	CB2	F2PA	30A	• KR161F Configurable Provision Relay 6
3	CB3	F3PA	30A	• KR161G Configurable Provision Relay 7
4	CB4	F4PA	20A	• KR161H Configurable Provision Relay 8
5	CB5	F5PA	20A	• KR161J Configurable Provision Relay 9
6	CB6A	F6PA	20A	• KR161K Configurable Provision Relay 10
7	CB6B	F7PA	20A	• KR161L Configurable Provision Relay 11
8	CB8	F8PA	5A	• KR73 Ignition Main Relay

Usage Table (cont'd)

No.	Device Label Name	Device Assigned Name	Rating	Description
Relays				
1	RELAY 1	KR161E Configurable Provision Relay 5	—	• W25 Blunt Cut Configurable Provision (BU)
2	RELAY 2	KR161F Configurable Provision Relay 6	—	• W25 Blunt Cut Configurable Provision (RD)
3	RELAY 3	KR161G Configurable Provision Relay 7	—	• W25 Blunt Cut Configurable Provision (OG)
4	RELAY 4	KR161H Configurable Provision Relay 8	—	• W25 Blunt Cut Configurable Provision (YE)
5	RELAY 5	KR161J Configurable Provision Relay 9	—	• W25 Blunt Cut Configurable Provision (GN)
6	RELAY 6A	KR161K Configurable Provision Relay 10	—	• W25 Blunt Cut Configurable Provision (BN)
7	RELAY 6B	KR161L Configurable Provision Relay 11	—	• W25 Blunt Cut Configurable Provision (BK)
8	RELAY 8 IGN	KR73 Ignition Main Relay	—	• S181E Configurable Provision Switch 5 • S181F Configurable Provision Switch 6 • S181G Configurable Provision Switch 7 • S181H Configurable Provision Switch 8 • S181J Configurable Provision Switch 9 • S181K Configurable Provision Switch 10

X54G Fuse Block - Body Provision X1 (UEH)



5479940

Connector Part Information

Harness Type: Roof Accessory Wiring Harness
OEM Connector: 3590906C1
Service Connector: Service by Harness - See Part Catalog
Description: 8-Way F 280 Metri-Pack Series, Sealed(BK)

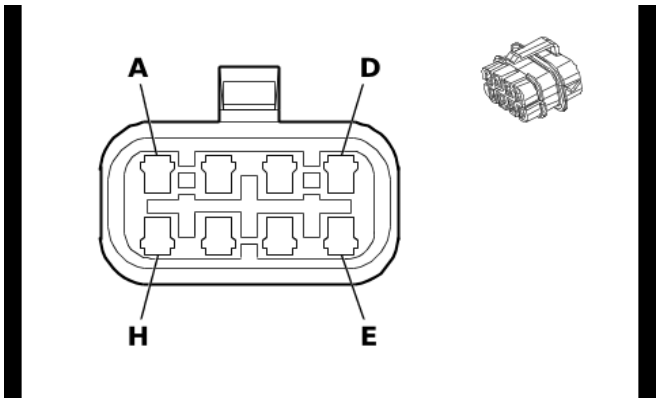
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-4A (PU)	No Tool Required

X54G Fuse Block - Body Provision X1 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	3.31	RD	1B	Configurable Provision 6 Control	I	—
B	3.31	OG	1C	Configurable Provision 7 Control	I	—
C	0.83	OG	13B	Run/Crank Ignition Voltage	I	—
D	1.31	BU	1A	Configurable Provision 5 Control	I	—
E - H	—	—	—	Not Occupied	—	—

X54G Fuse Block - Body Provision X2 (UEH)



5479940

Connector Part Information

Harness Type: Roof Accessory Wiring Harness
OEM Connector: 3590905C1
Service Connector: Service by Harness - See Part Catalog
Description: 8-Way F 280 Metri-Pack Series, Sealed(GY)

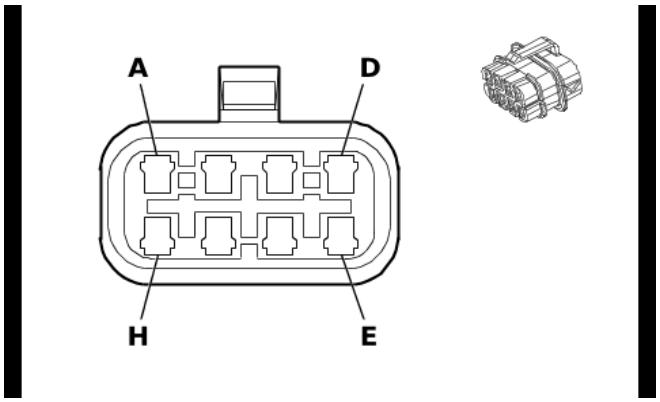
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-4A (PU)	No Tool Required

X54G Fuse Block - Body Provision X2 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	1.31	BN	1F	Configurable Provision 10 Control 1	I	—
B	1.31	BK	1G	Configurable Provision 10 Control 2	I	—
C	1.31	YE	1D	Configurable Provision 8 Control	I	—
D	1.31	GN	1E	Configurable Provision 9 Control	I	—
E - H	—	—	—	Not Occupied	—	—

X54G Fuse Block - Body Provision X3 (UEH)



5479940

Connector Part Information

Harness Type: Roof Accessory Wiring Harness
OEM Connector: 3814193C1
Service Connector: Service by Harness - See Part Catalog
Description: 8-Way F 280 Metri-Pack Series, Sealed

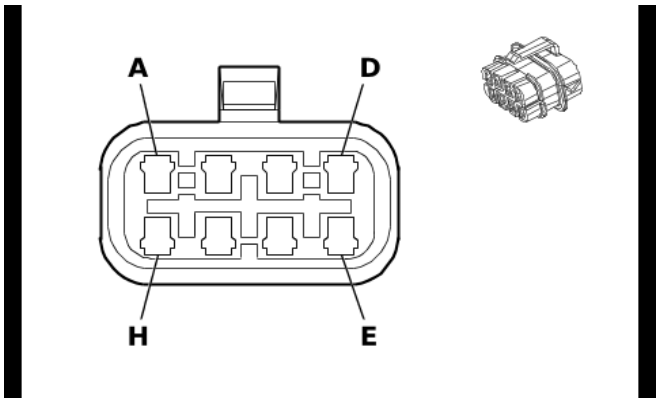
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-4A (PU)	No Tool Required

X54G Fuse Block - Body Provision X3 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	0.83	PK	12F	Configurable Provision Relay 10 Control	I	—
B	0.83	PK	12F	Configurable Provision Relay 10 Control	I	—
C - E	—	—	—	Not Occupied	—	—
F	0.83	PK	12C	Configurable Provision Relay 7 Control	I	—
G	0.83	PK	12E	Configurable Provision Relay 9 Control	I	—
H	0.83	PK	12D	Configurable Provision Relay 8 Control	I	—

X54G Fuse Block - Body Provision X4 (UEH)



5479940

Connector Part Information

Harness Type: Roof Accessory Wiring Harness
OEM Connector: 3814194C1
Service Connector: Service by Harness - See Part Catalog
Description: 8-Way F 280 Metri-Pack Series, Sealed

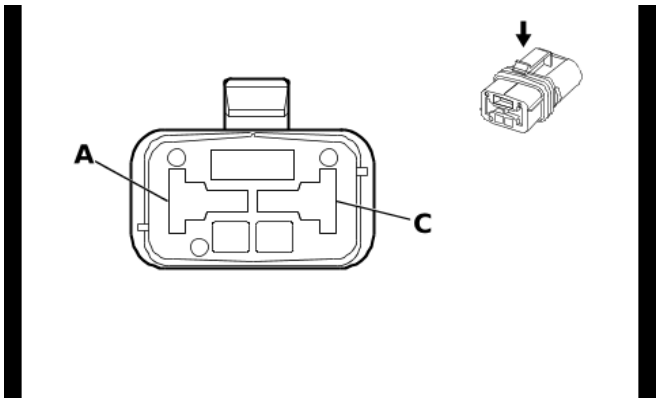
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-4A (PU)	No Tool Required
I	Not required	J-35616-4A (PU)	No Tool Required

X54G Fuse Block - Body Provision X4 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A - B	—	—	—	Not Occupied	—	—
C	0.83	PK	13A	Run/Crank Ignition Voltage	I	—
D	0.83	PK	12B	Configurable Provision Relay 6 Control	I	—
E	0.83	PK	12A	Configurable Provision Relay 5 Control	I	—
F	18	WH	11A	Ground	I	—
G - H	—	—	—	Not Occupied	—	—

X54G Fuse Block - Body Provision X5 (UEH)



5482244

Connector Part Information

Harness Type: Accessory Power Fuse Block Rear Wiring Harness
OEM Connector: 3590903C1
Service Connector: Service by Harness - See Part Catalog
Description: 2-Way F 800 Metri-Pack Series, Sealed(GY)

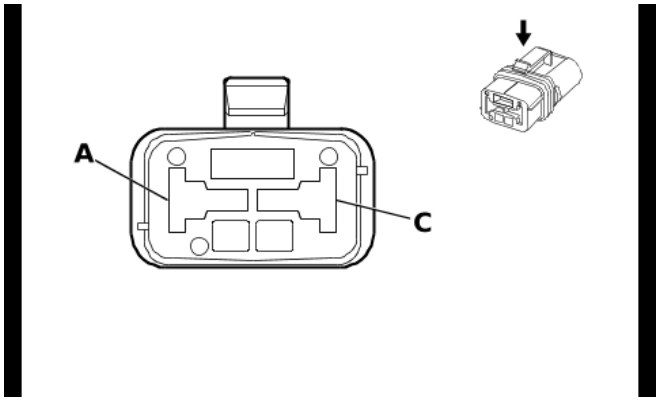
Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-44 (YE)	No Tool Required

X54G Fuse Block - Body Provision X5 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	8.37	RD	1A	Battery Positive Voltage	I	—
C	8.37	RD	1A	Battery Positive Voltage	I	—

X54G Fuse Block - Body Provision X6 (UEH)



5482244

Connector Part Information

Harness Type: Accessory Power Fuse Block Rear Wiring Harness
OEM Connector: 3590904C1
Service Connector: Service by Harness - See Part Catalog
Description: 2-Way F 800 Metri-Pack Series, Sealed(BK)

Terminal Part Information

Terminal Type ID	Terminated Lead	Diagnostic Test Probe	Terminal Removal Tool
I	Not required	J-35616-44 (YE)	No Tool Required

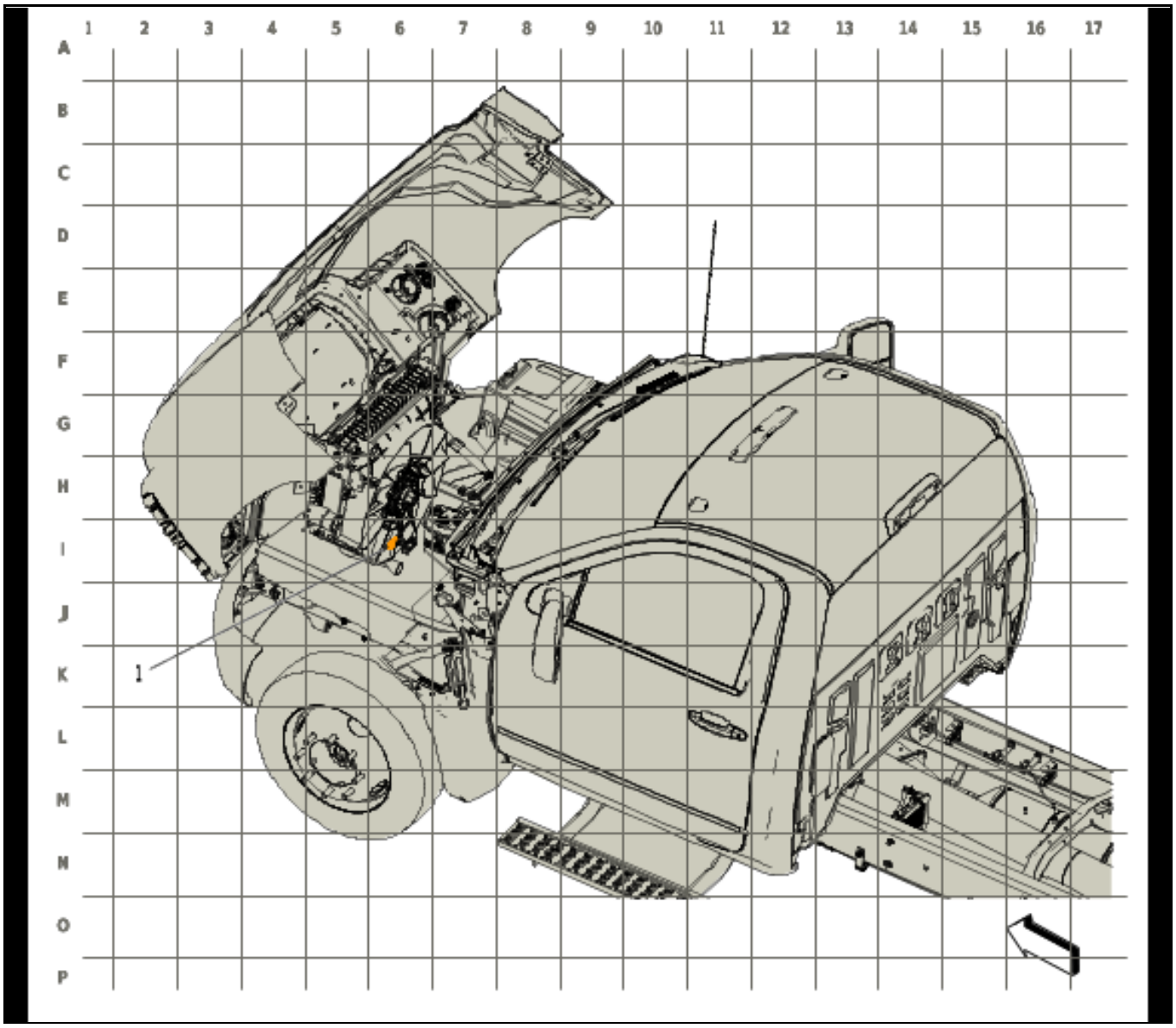
X54G Fuse Block - Body Provision X6 (UEH)

Pin	Size	Color	Circuit	Function	Terminal Type ID	Option
A	8.37	RD	1B	Battery Positive Voltage	I	—
C	8.37	RD	1B	Battery Positive Voltage	I	—

Electrical Component Locator and Harness Routing Views

Schematic and Routing Diagrams

Harness Routing Views (Fan Blade Clutch Wiring Harness Routing)

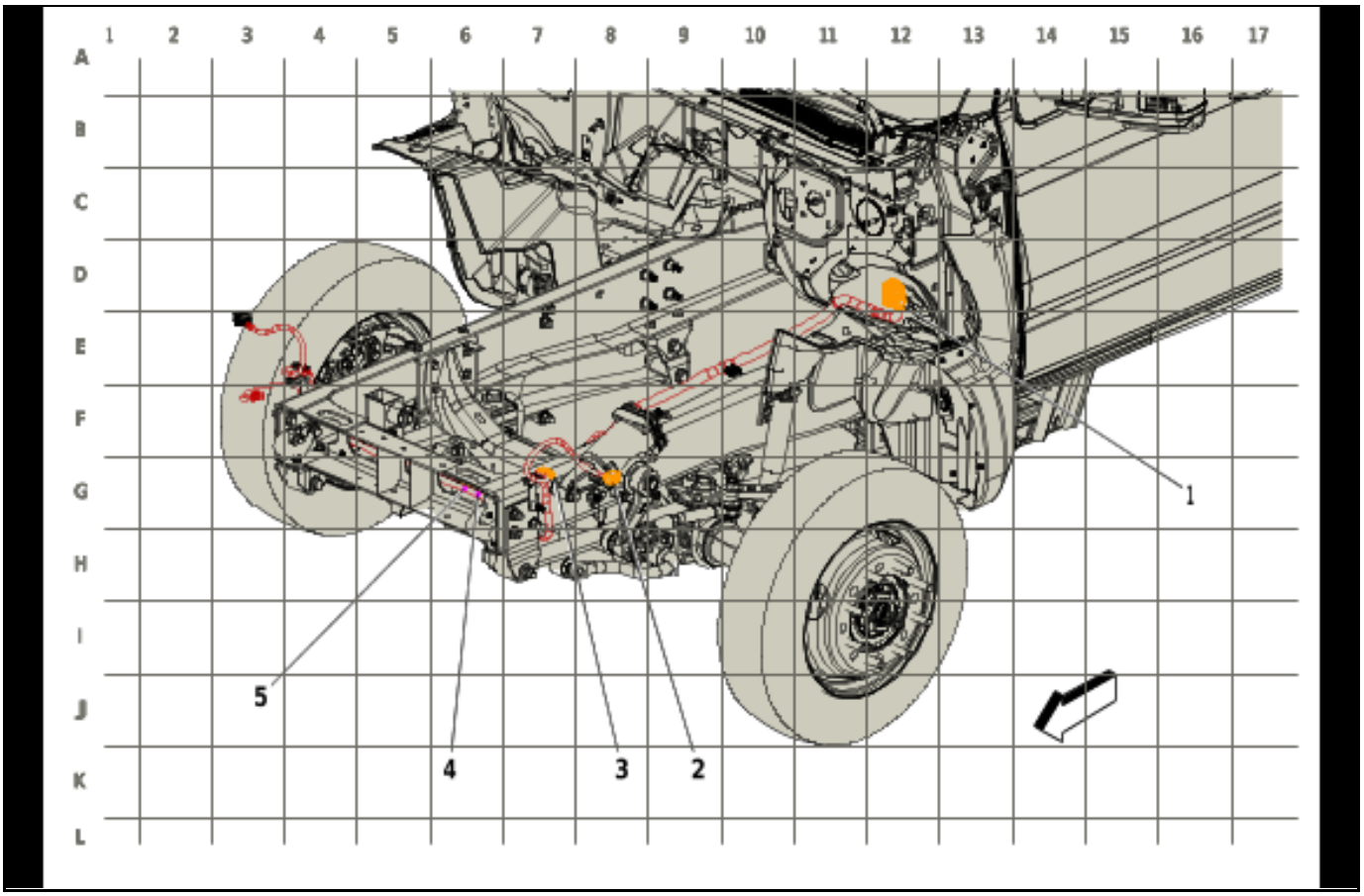


5132063

Items

(1) X102 Engine Wiring Harness - Chassis to Fan Blade Clutch Wiring Harness

Harness Routing Views (Body Front and Engine Wiring Harness Routing - Left Front)



5278601

Items

(1) X150 Body Front and Engine Wiring Harness to Body Wiring Harness

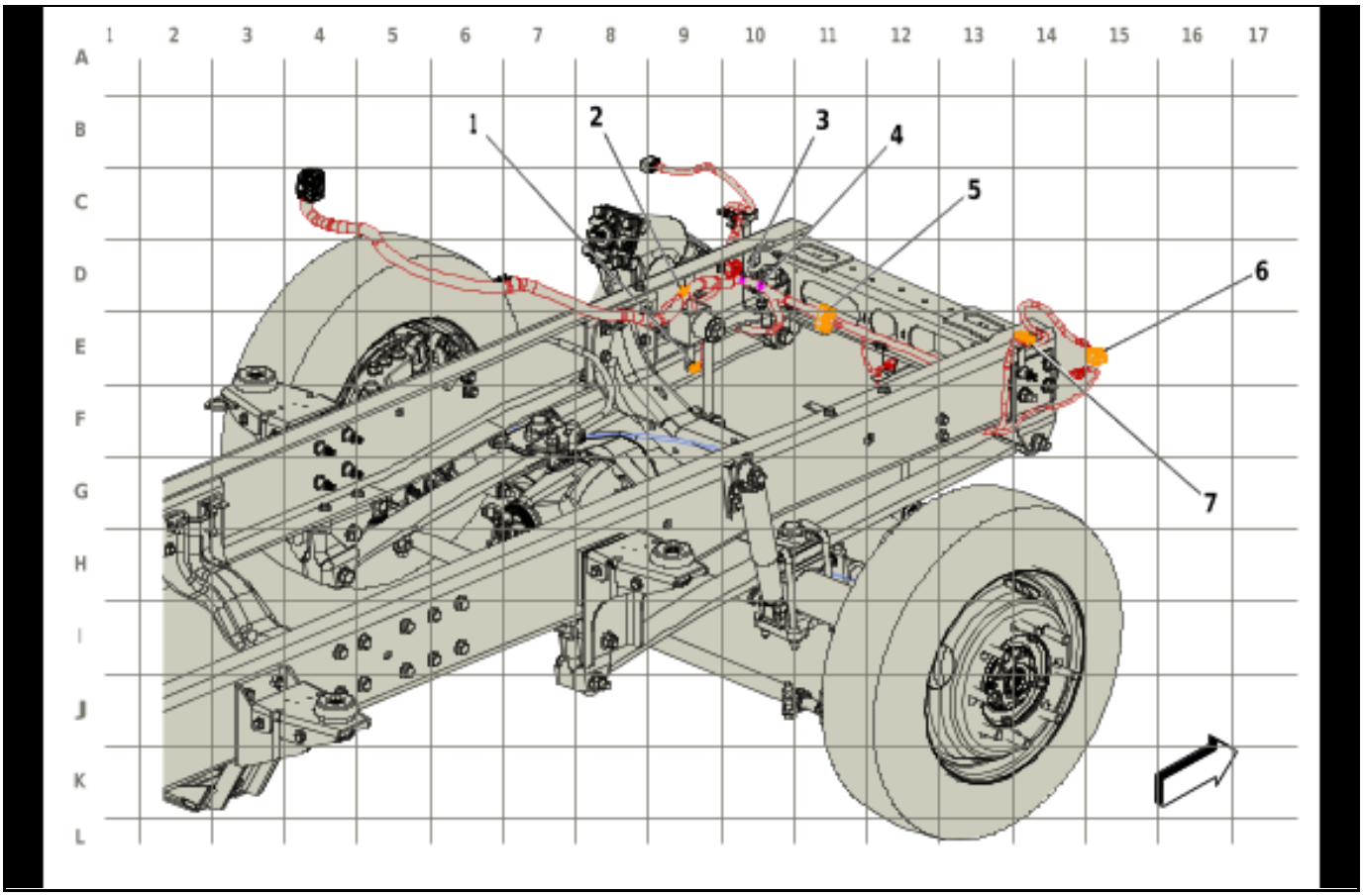
(2) X109 Headlamp Wiring Harness - Left to Body Front and Engine Wiring Harness

(3) X108 Body Front and Engine Wiring Harness to Front Fog Lamp Wiring Harness - Left (T3U)

(4) J105 Body Front and Engine Wiring Harness

(5) J104 Body Front and Engine Wiring Harness (T3U)

Harness Routing Views (Body Front and Engine Wiring Harness Routing - Right Front)



5278605

Items

(1) X103 Body Front and Engine Wiring Harness to Horn Wiring Harness

(2) X104 Body Front and Engine Wiring Harness to Radiator Ground

(3) J102 Body Front and Engine Wiring Harness

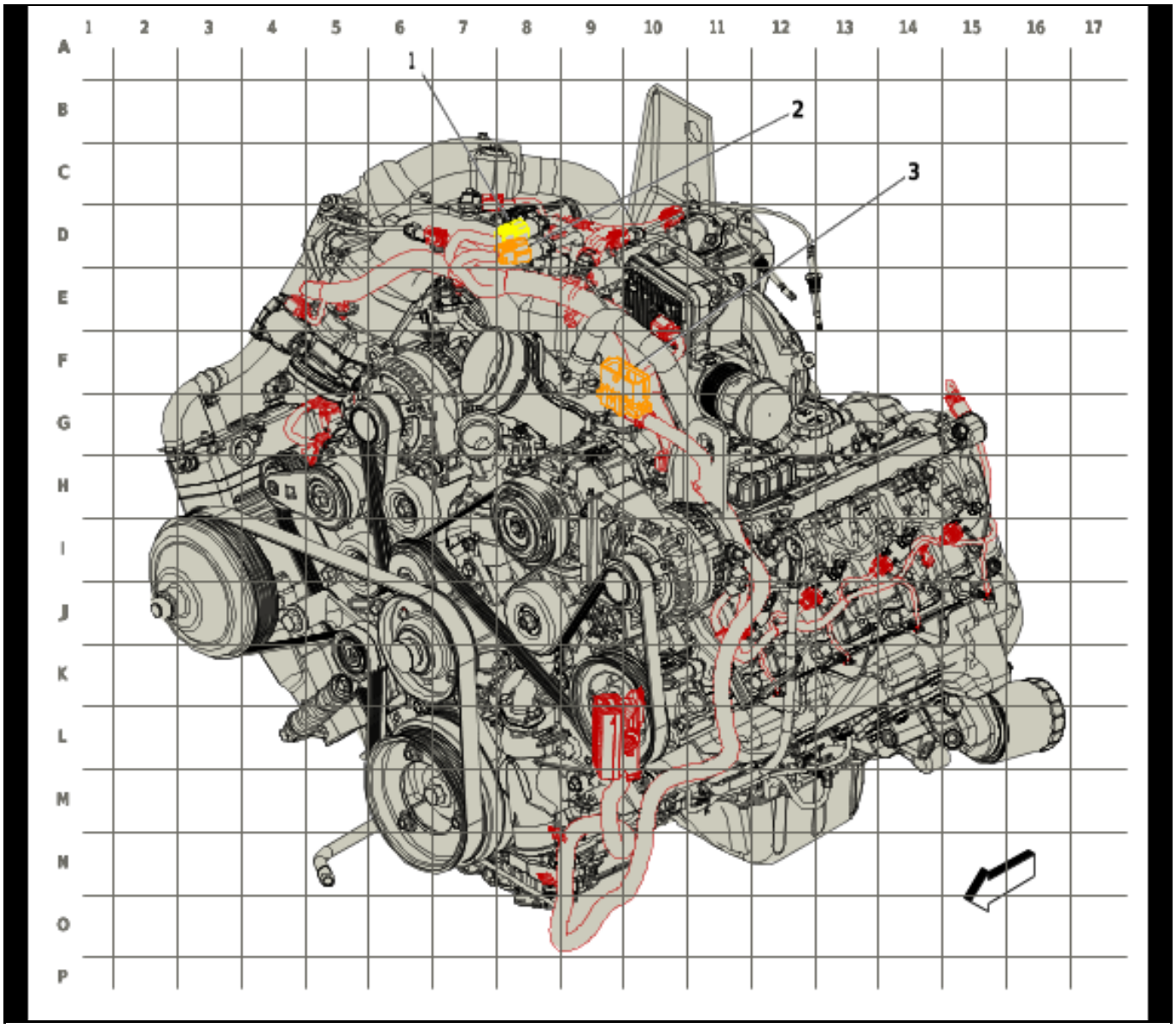
(4) J101 Body Front and Engine Wiring Harness (T3U)

(5) JX100 Body Front and Engine Wiring Harness

(6) X119 Headlamp Wiring Harness - Right to Body Front and Engine Wiring Harness

(7) X118 Body Front and Engine Wiring Harness to Front Fog Lamp Wiring Harness - Right (T3U)

Harness Routing Views (Engine Wiring Harness Routing - Left Front)



4975496

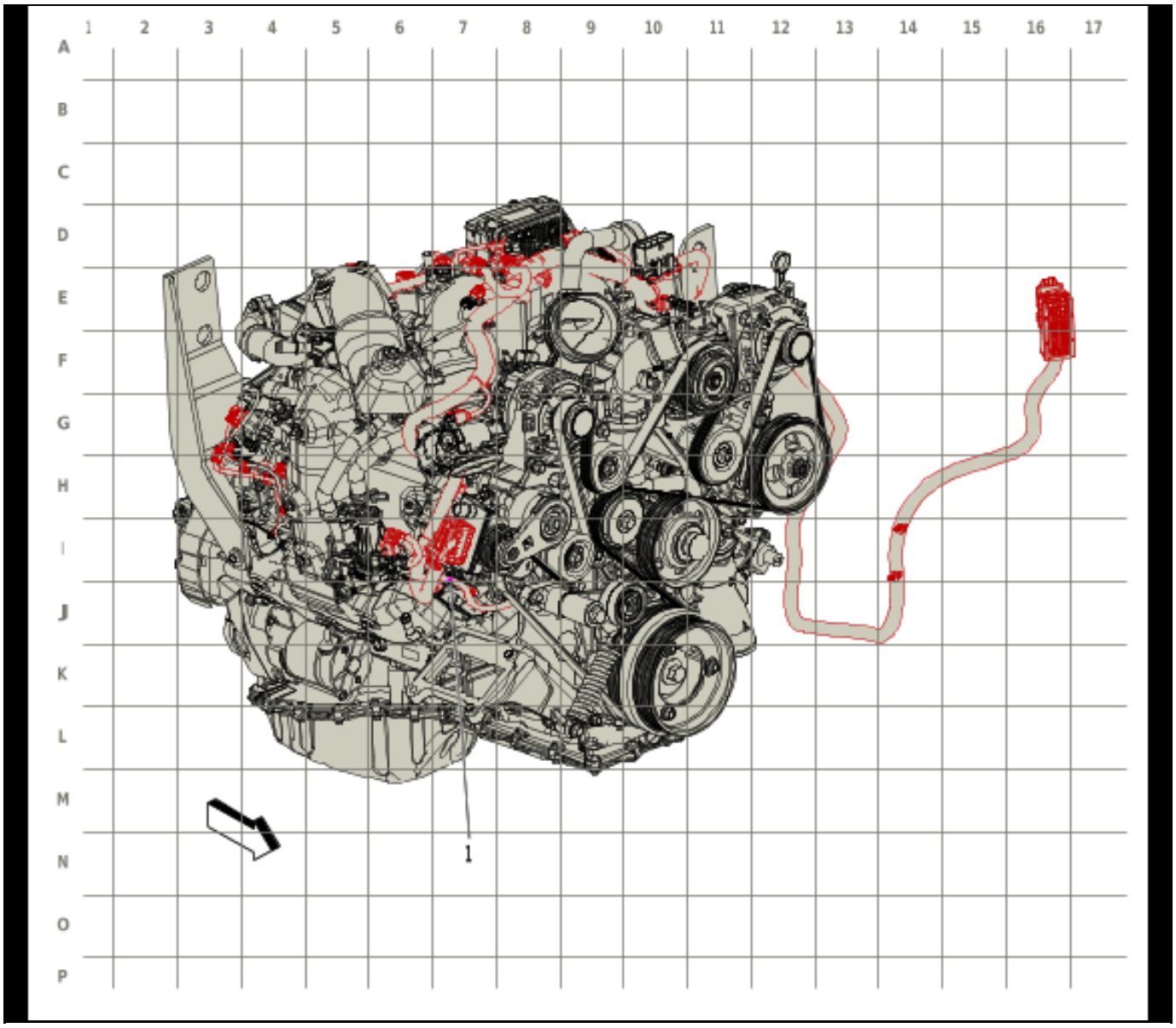
Items

(1) X112 Engine Wiring Harness to Engine Wiring Harness - Jumper

(2) X113 Engine Wiring Harness to Engine Wiring Harness - Jumper

(3) X101 Engine Wiring Harness - Chassis to Engine Wiring Harness

Harness Routing Views (Engine Wiring Harness Routing - Right Front)

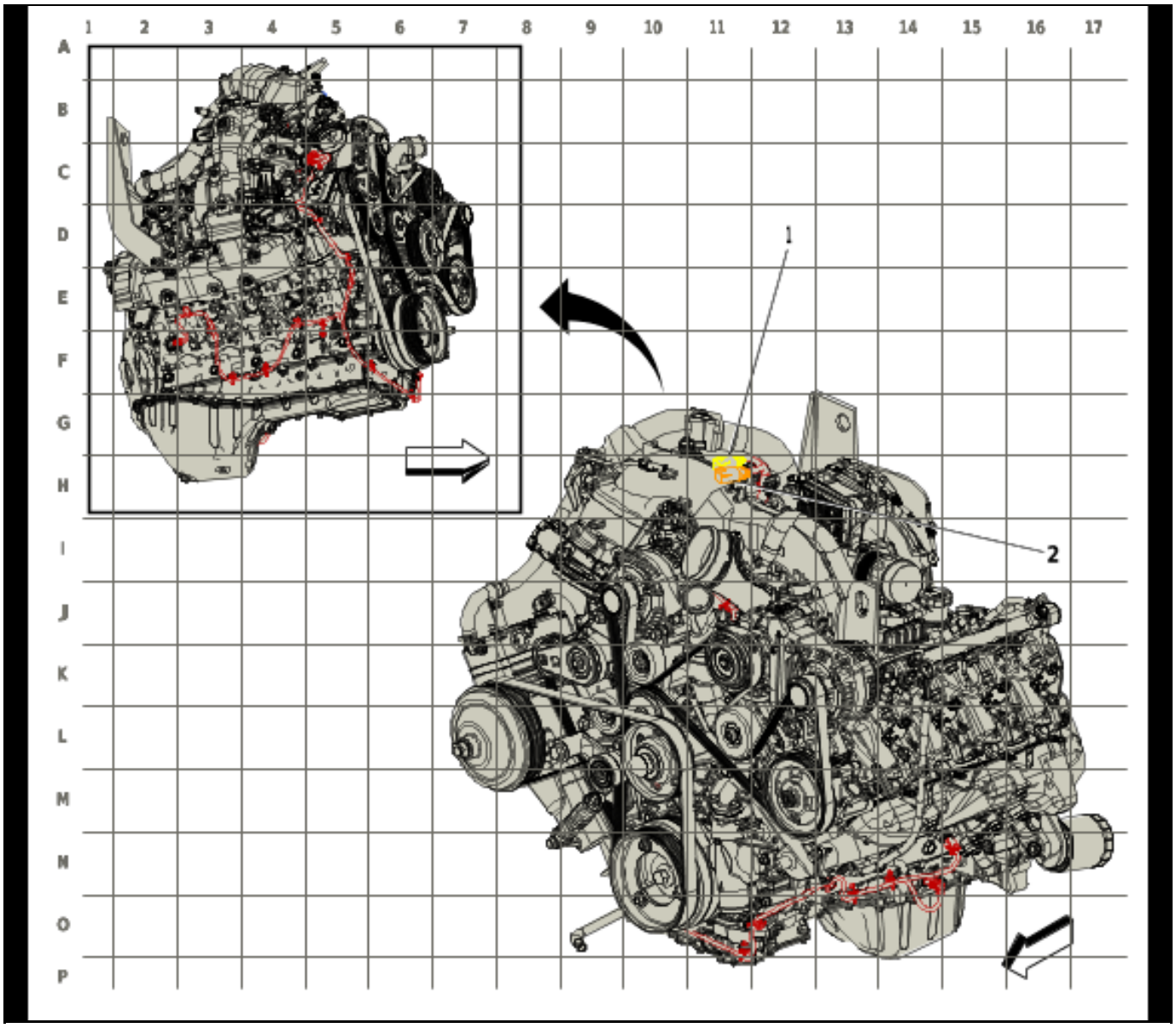


4975498

Items

(1) J124 Engine Wiring Harness - Chassis

Harness Routing Views (Engine Wiring Harness - Jumper Routing)



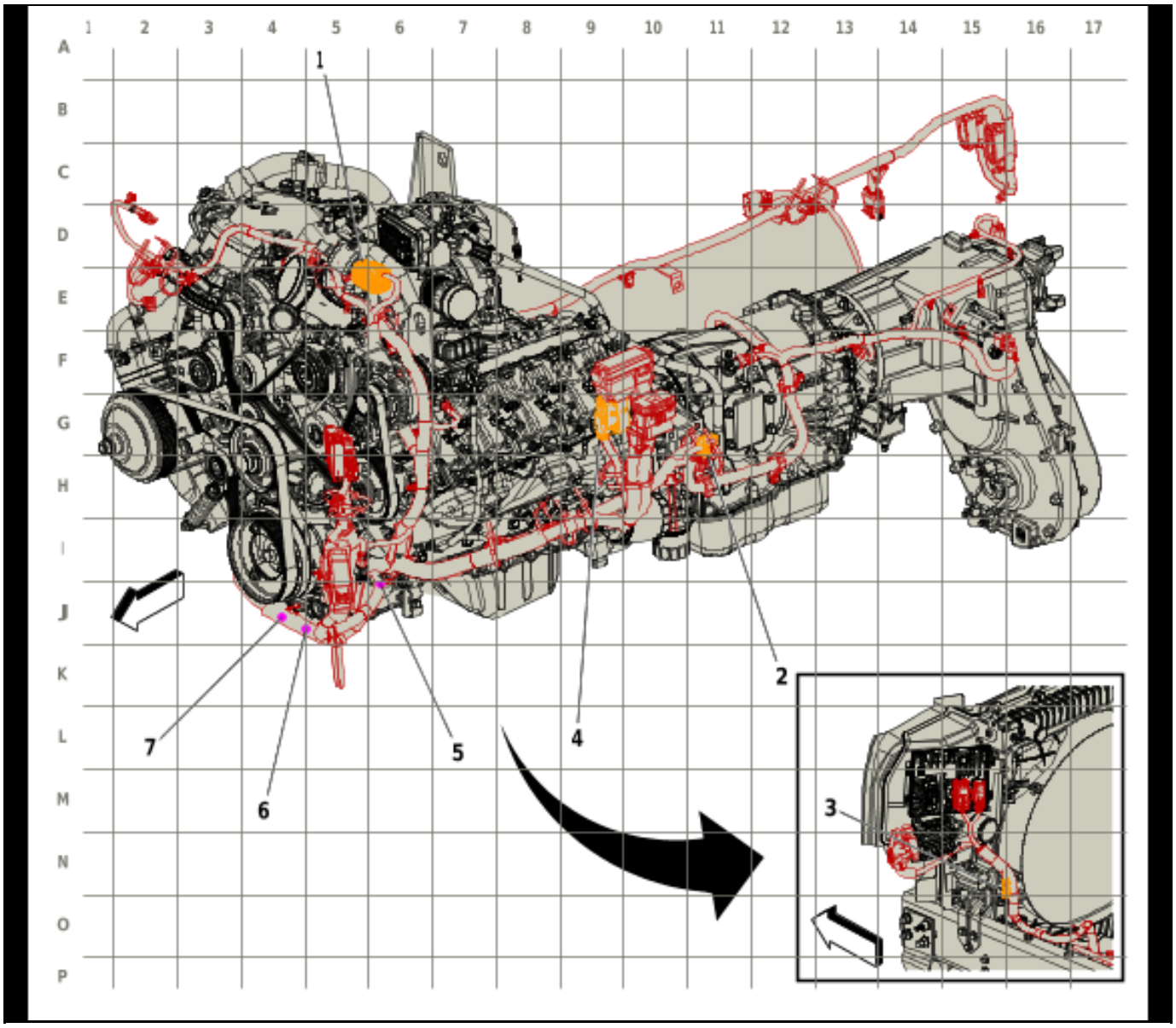
4975499

Items

(1) X112 Engine Wiring Harness to Engine Wiring Harness - Jumper

(2) X113 Engine Wiring Harness to Engine Wiring Harness - Jumper

Harness Routing Views (Engine Wiring Harness - Chassis Routing - Left)



4975500

Items

(1) X101 Engine Wiring Harness - Chassis to Engine Wiring Harness

(2) X125 Engine Wiring Harness - Chassis to Chassis Front Wiring Harness

(3) X105 Engine Wiring Harness - Chassis to Engine Wiring Harness - Chassis

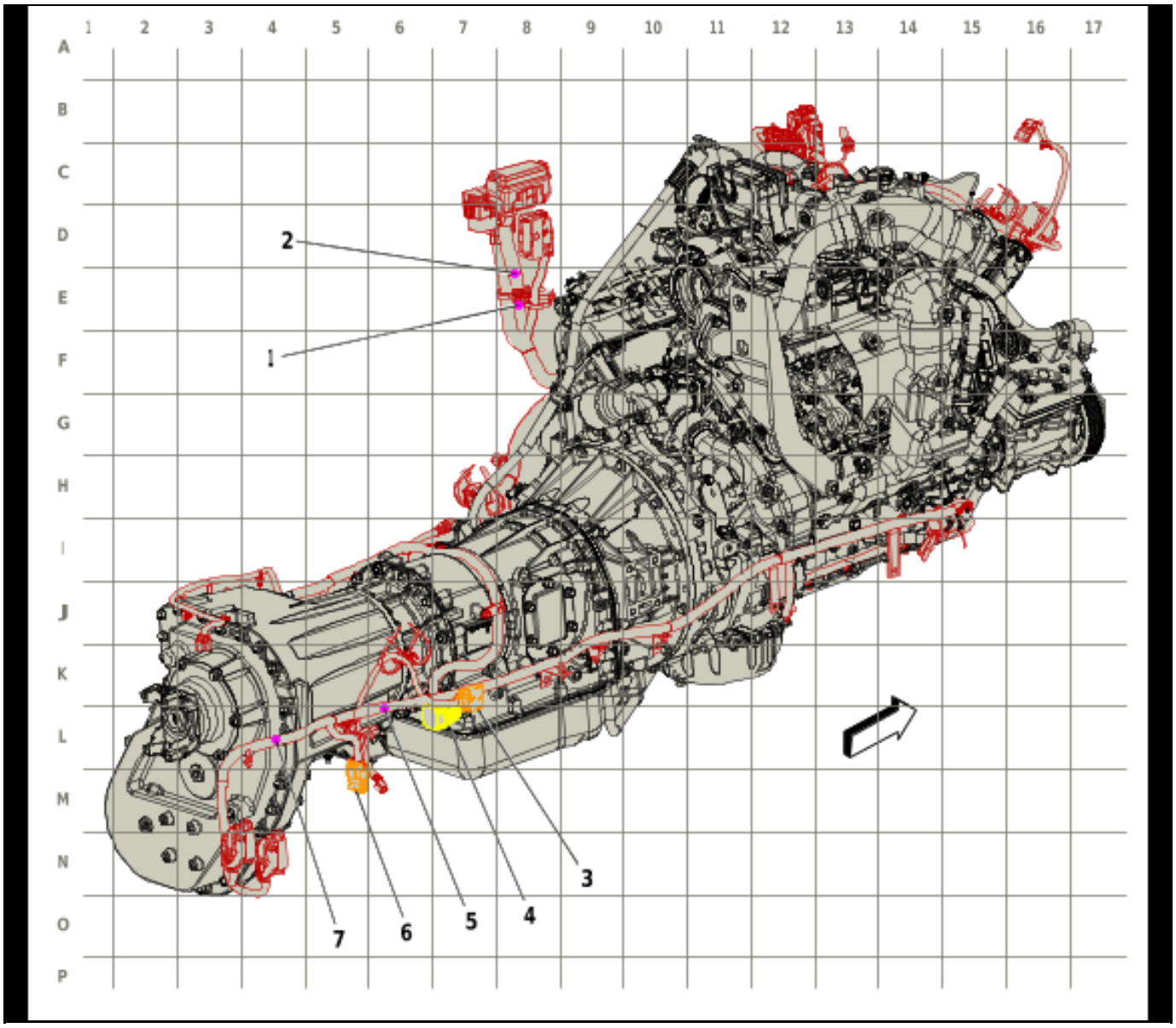
(4) X115 Engine Wiring Harness - Chassis to Body Wiring Harness

(5) J123 Engine Wiring Harness - Chassis

(6) J124 Engine Wiring Harness - Chassis

(7) J126 Engine Wiring Harness - Chassis

Harness Routing Views (Engine Wiring Harness - Chassis Routing - Right)



4975504

Items

(1) J196 Engine Wiring Harness - Chassis

(2) J197 Engine Wiring Harness - Chassis

(3) X143 Emission Reduction Fluid Tank Reservoir Wire Harness - Module to Engine Wiring Harness - Chassis

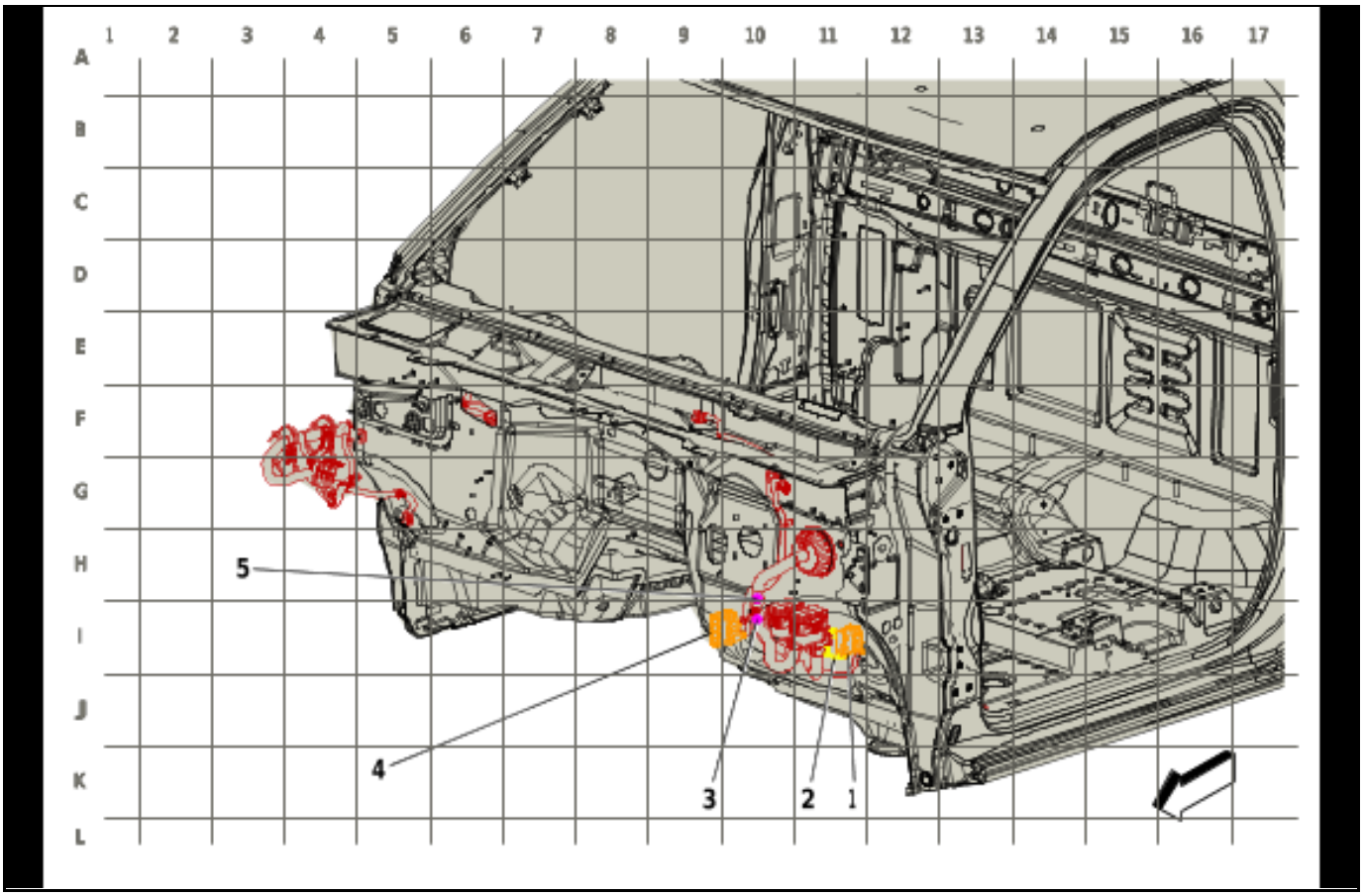
(4) X175 Engine Wiring Harness - Chassis to Automatic Transmission Wiring Harness

(5) J195 Engine Wiring Harness - Chassis (PTO)

(6) X191 Engine Wiring Harness - Chassis to Engine Wiring Harness - Chassis (PTO)

(7) J194 Engine Wiring Harness - Chassis (PTO)

Harness Routing Views (Body Wiring Harness Routing - Engine Compartment)



4992536

Items

(1) X138 Chassis Front Wiring Harness to Body Wiring Harness

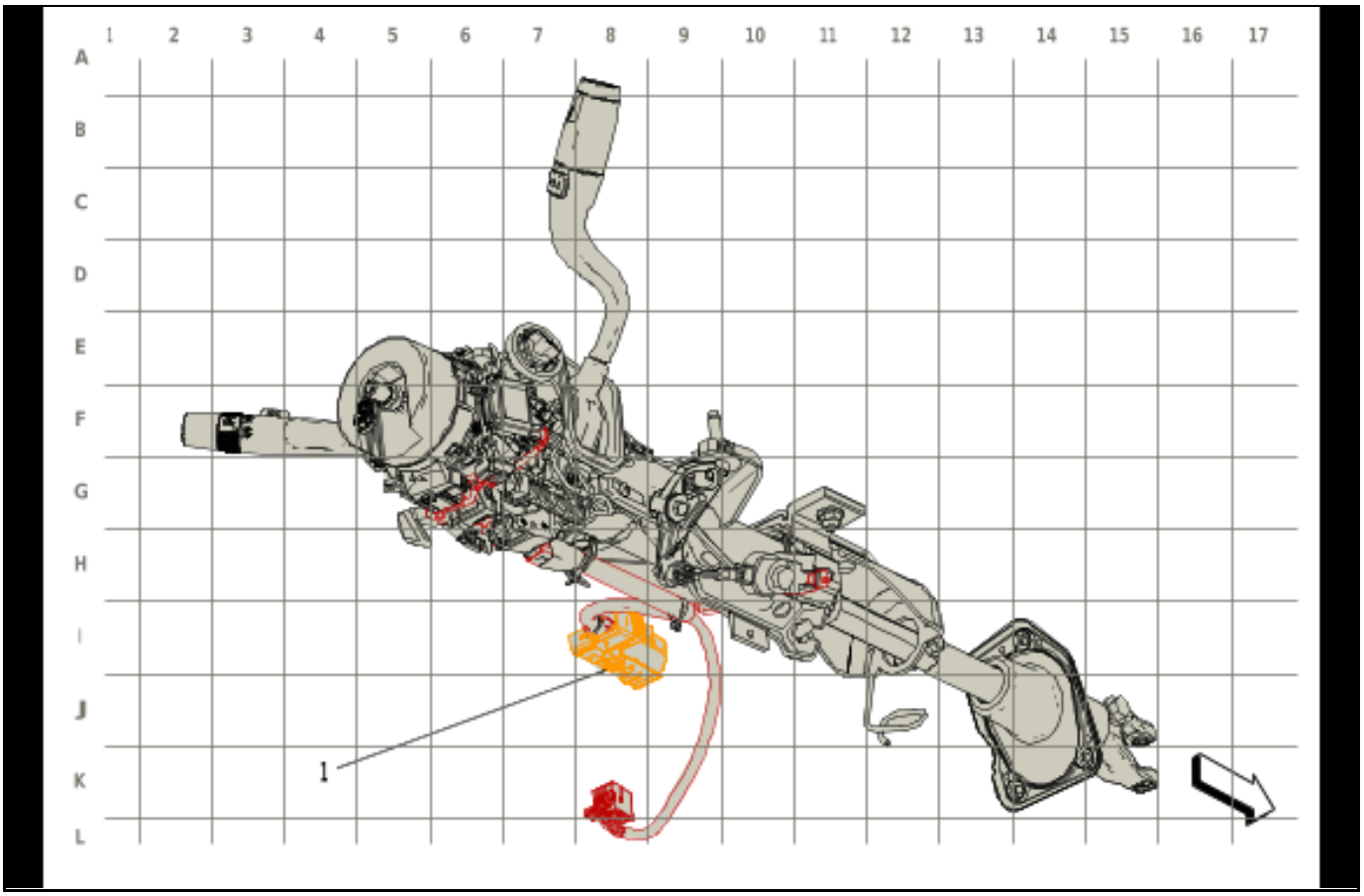
(2) X150 Body Front and Engine Wiring Harness to Body Wiring Harness

(3) J307 Body Wiring Harness

(4) X115 Engine Wiring Harness - Chassis to Body Wiring Harness

(5) J367 Body Wiring Harness

Harness Routing Views (Steering Column Wiring Harness Routing)

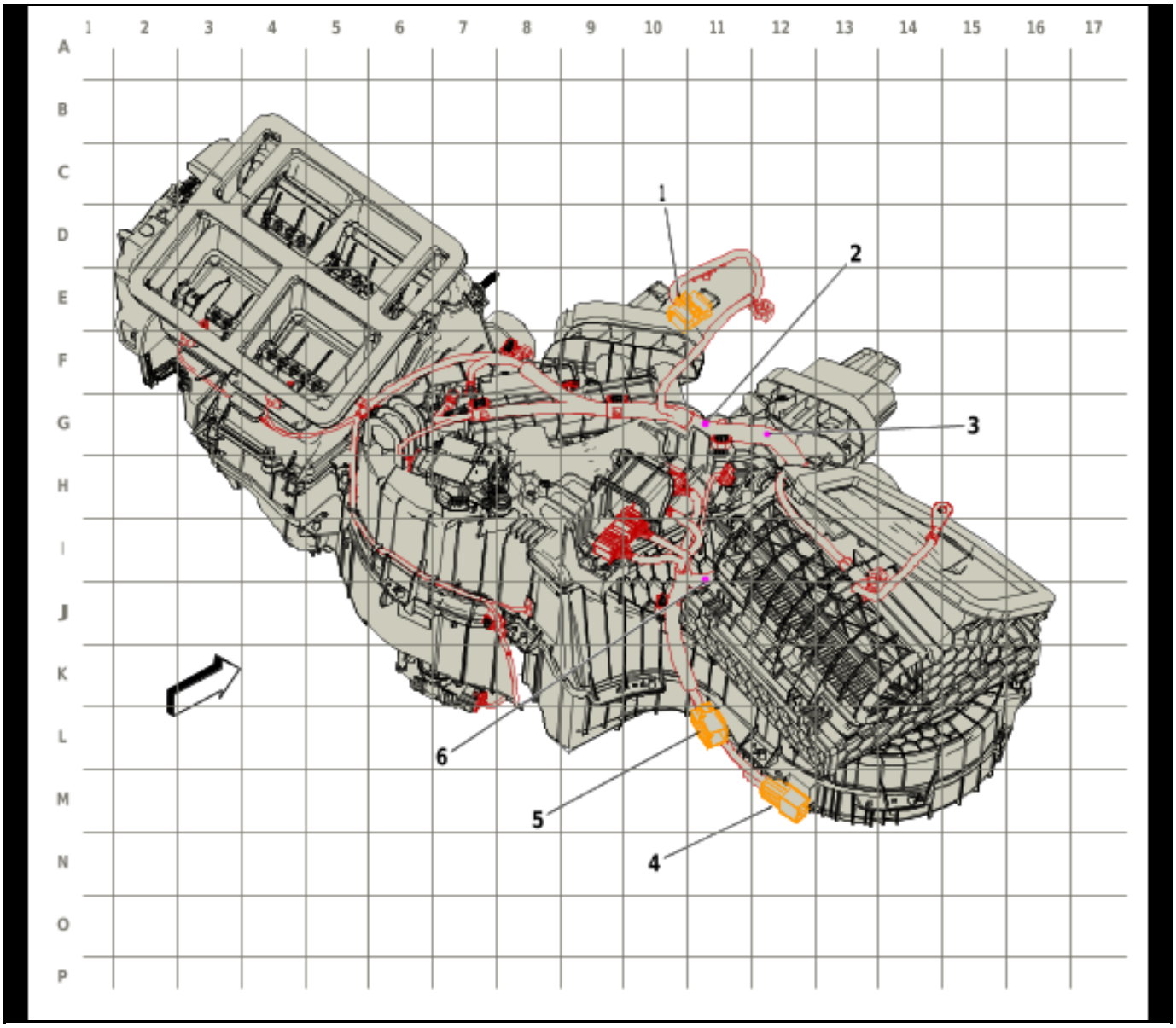


5132064

Items

(1) X201 Steering Column Wiring Harness to Instrument Panel Wiring Harness

Harness Routing Views (Air Conditioning Wiring Harness Routing)



4975507

Items

(1) X215 Air Conditioning Wiring Harness to Instrument Panel Wiring Harness

(2) J255 Air Conditioning Wiring Harness

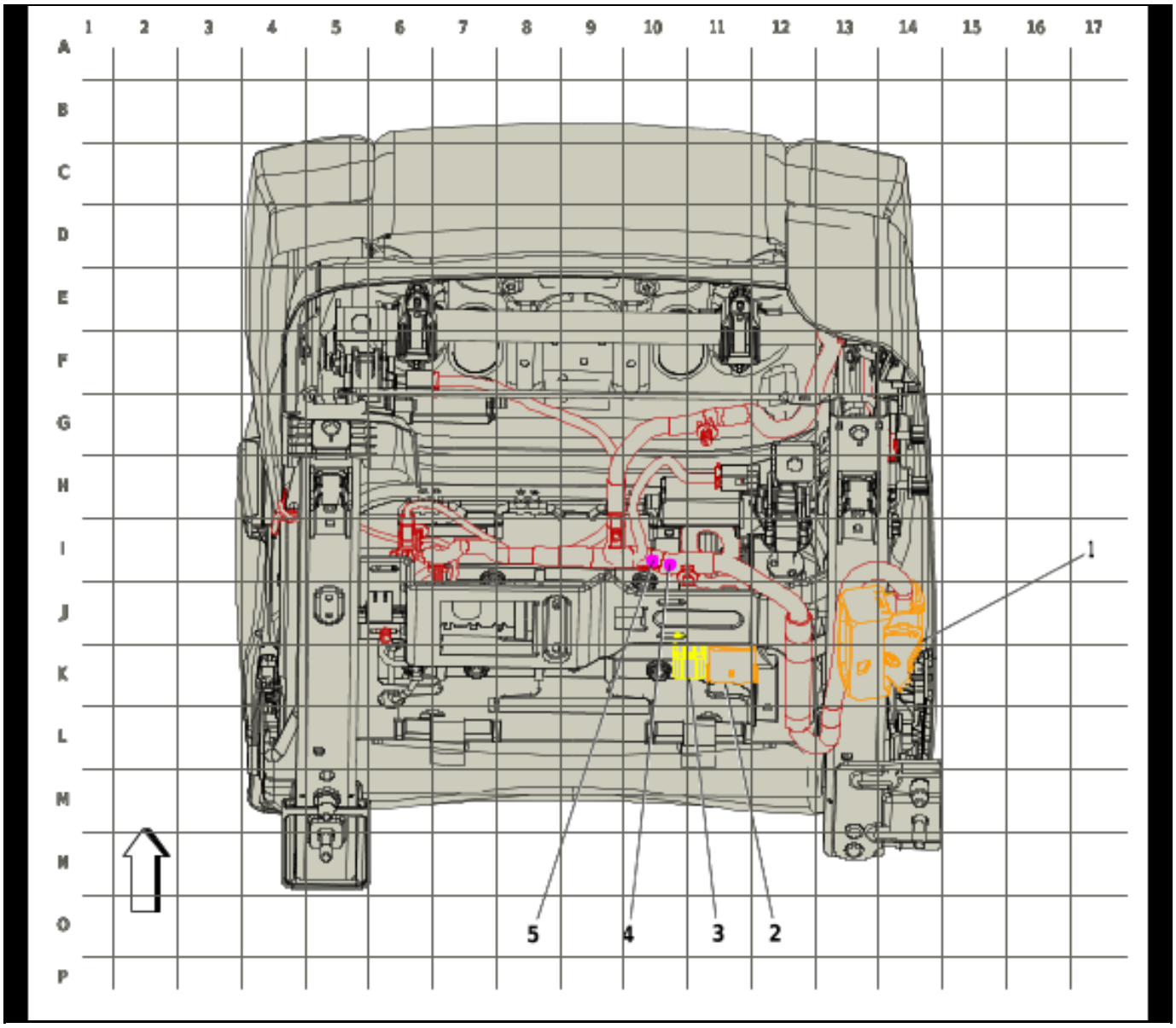
(3) J216 Air Conditioning Wiring Harness (C32)

(4) X217 Body Wiring Harness to Air Conditioning Wiring Harness

(5) X216 Body Wiring Harness to Air Conditioning Wiring Harness

(6) J257 Air Conditioning Wiring Harness

Harness Routing Views (Front Seat Cushion Wiring Harness - Driver Routing)



4975521

Items

(1) X310 Front Seat Cushion Wiring Harness - Driver to Body Wiring Harness

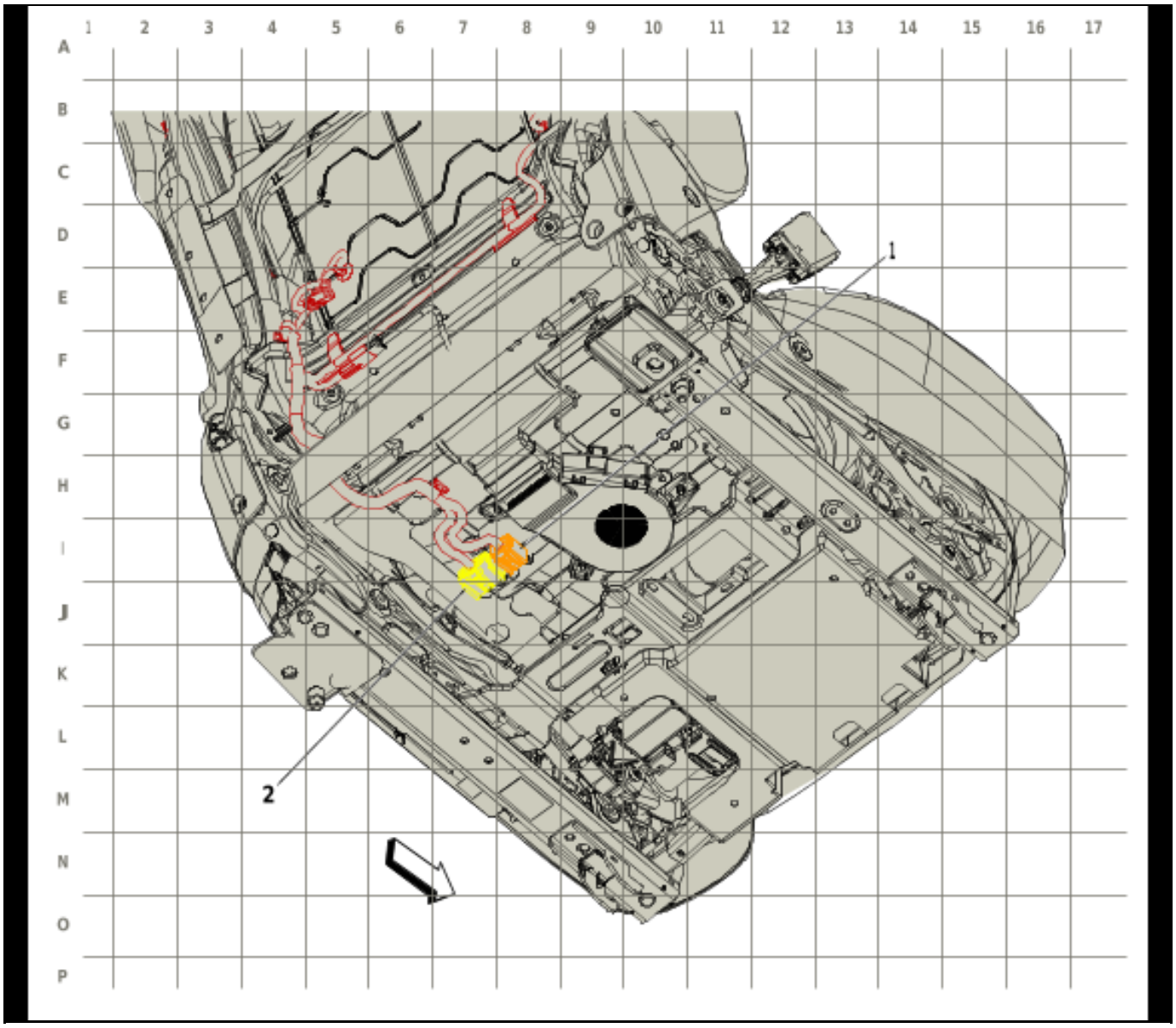
(2) X312 Front Seat Back Wiring Harness - Driver to Front Seat Cushion Wiring Harness - Driver

(3) X311 Front Seat Back Wiring Harness - Driver to Front Seat Cushion Wiring Harness - Driver (A95/AG1)

(4) J320 Front Seat Cushion Wiring Harness - Driver (KA1)

(5) J319 Front Seat Cushion Wiring Harness - Driver (KA1)

Harness Routing Views (Front Seat Back Wiring Harness - Driver Routing)



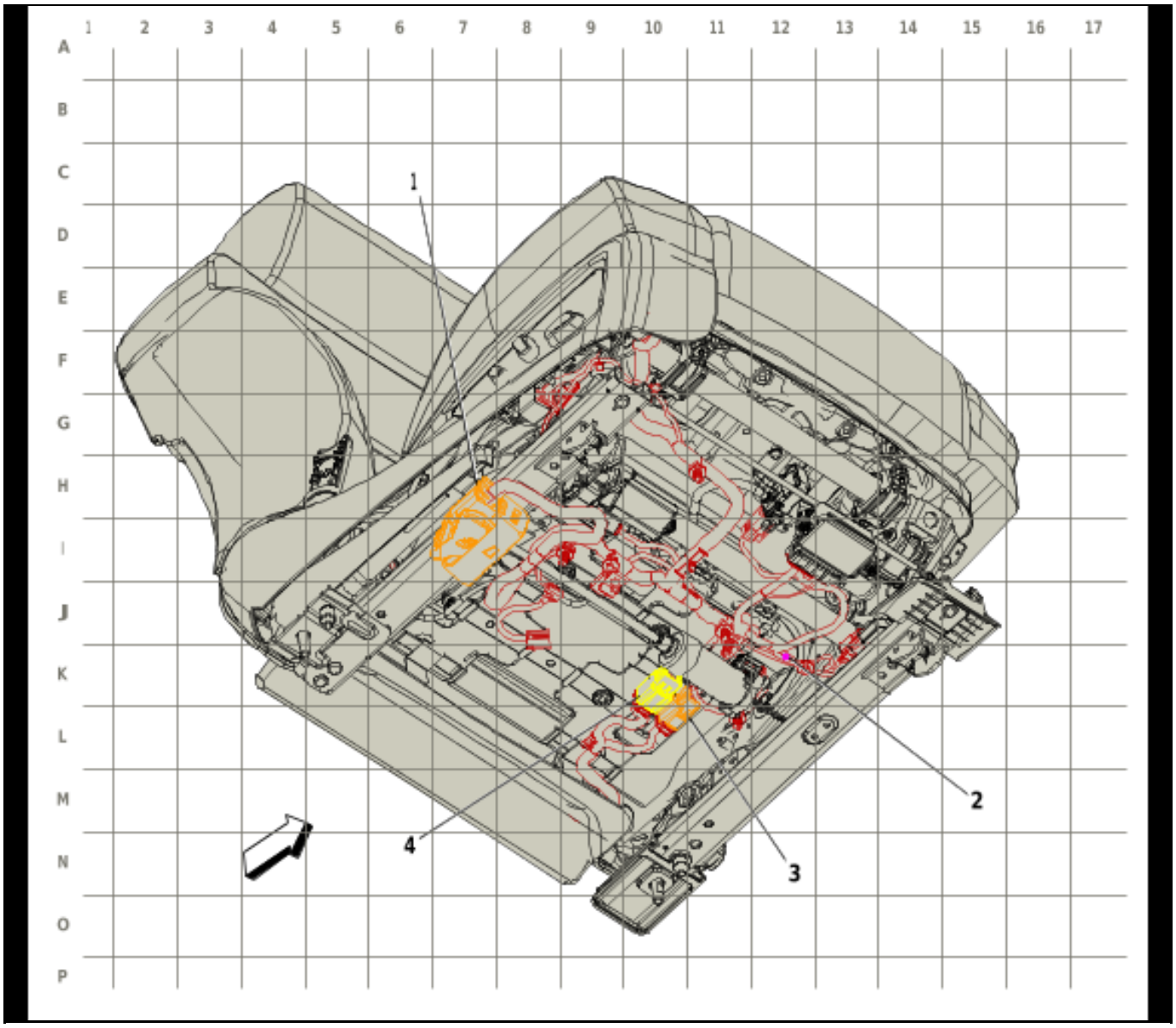
4975523

Items

(1) X311 Front Seat Back Wiring Harness - Driver to Front Seat Cushion Wiring Harness - Driver (A95/AG1)

(2) X312 Front Seat Back Wiring Harness - Driver to Front Seat Cushion Wiring Harness - Driver

Harness Routing Views (Front Seat Cushion Wiring Harness - Passenger Routing)



4975525

Items

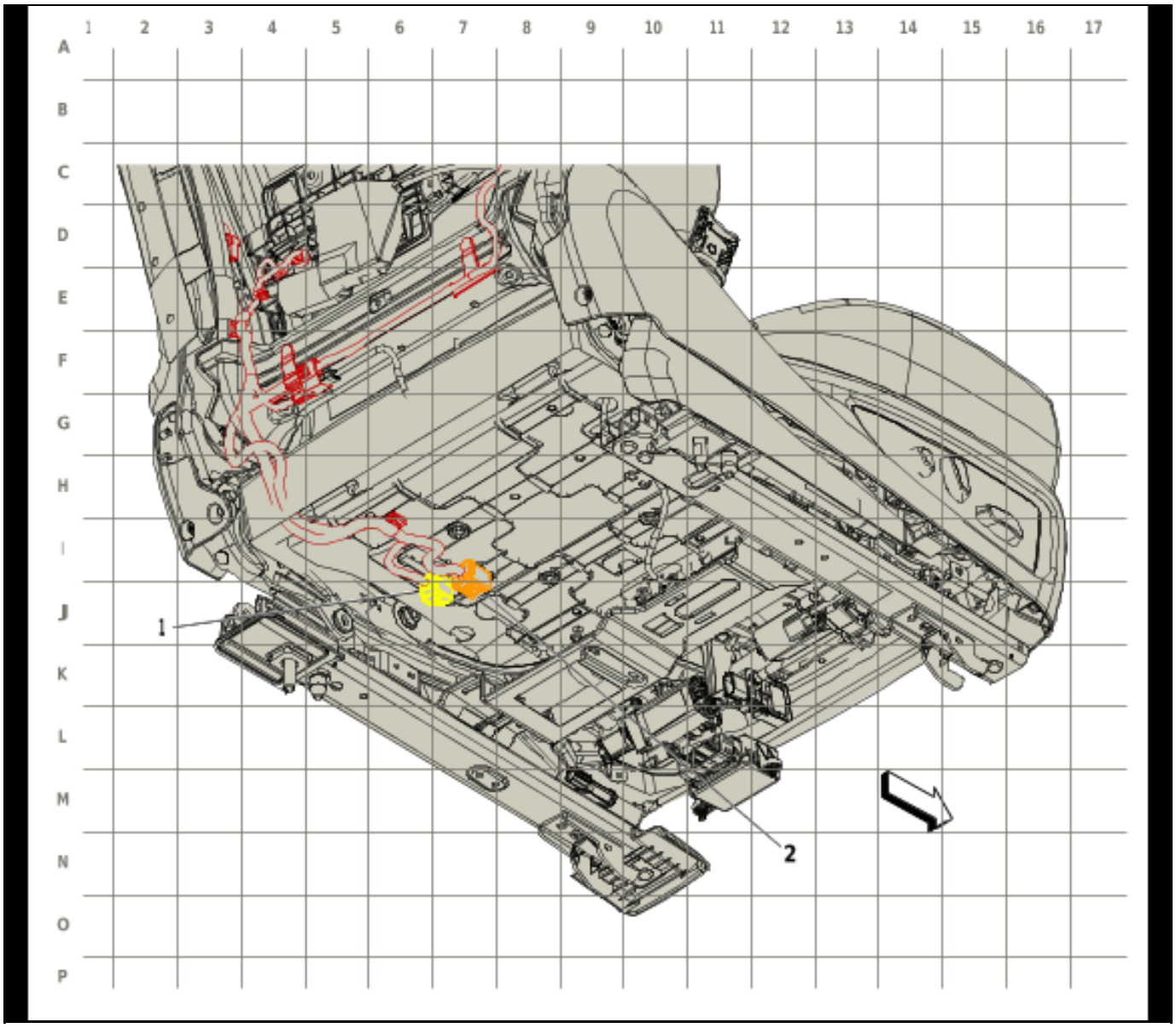
(1) X320 Front Seat Cushion Wiring Harness - Passenger to Body Wiring Harness

(2) J321 Front Seat Cushion Wiring Harness - Passenger (KA1)

(3) X322 Front Seat Back Wiring Harness - Passenger to Front Seat Cushion Wiring Harness - Passenger

(4) X321 Front Seat Back Wiring Harness - Passenger to Front Seat Cushion Wiring Harness - Passenger (A95)

Harness Routing Views (Front Seat Back Wiring Harness - Passenger Routing)



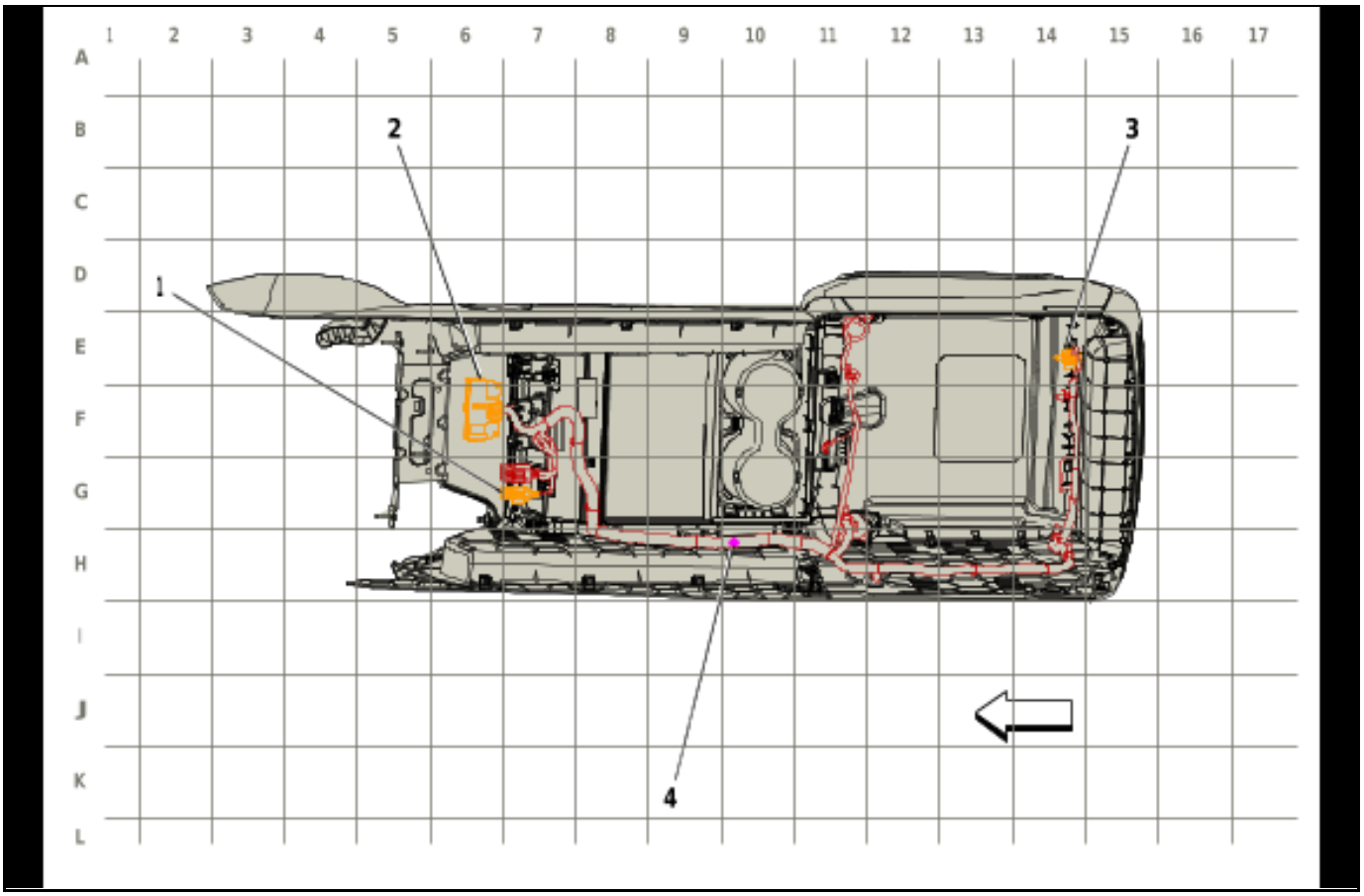
4975529

Items

(1) X322 Front Seat Back Wiring Harness - Passenger to Front Seat Cushion Wiring Harness - Passenger

(2) X321 Front Seat Back Wiring Harness - Passenger to Front Seat Cushion Wiring Harness - Passenger (A95)

Harness Routing Views (Front Floor Console Wiring Harness Routing (D07))



4975532

Items

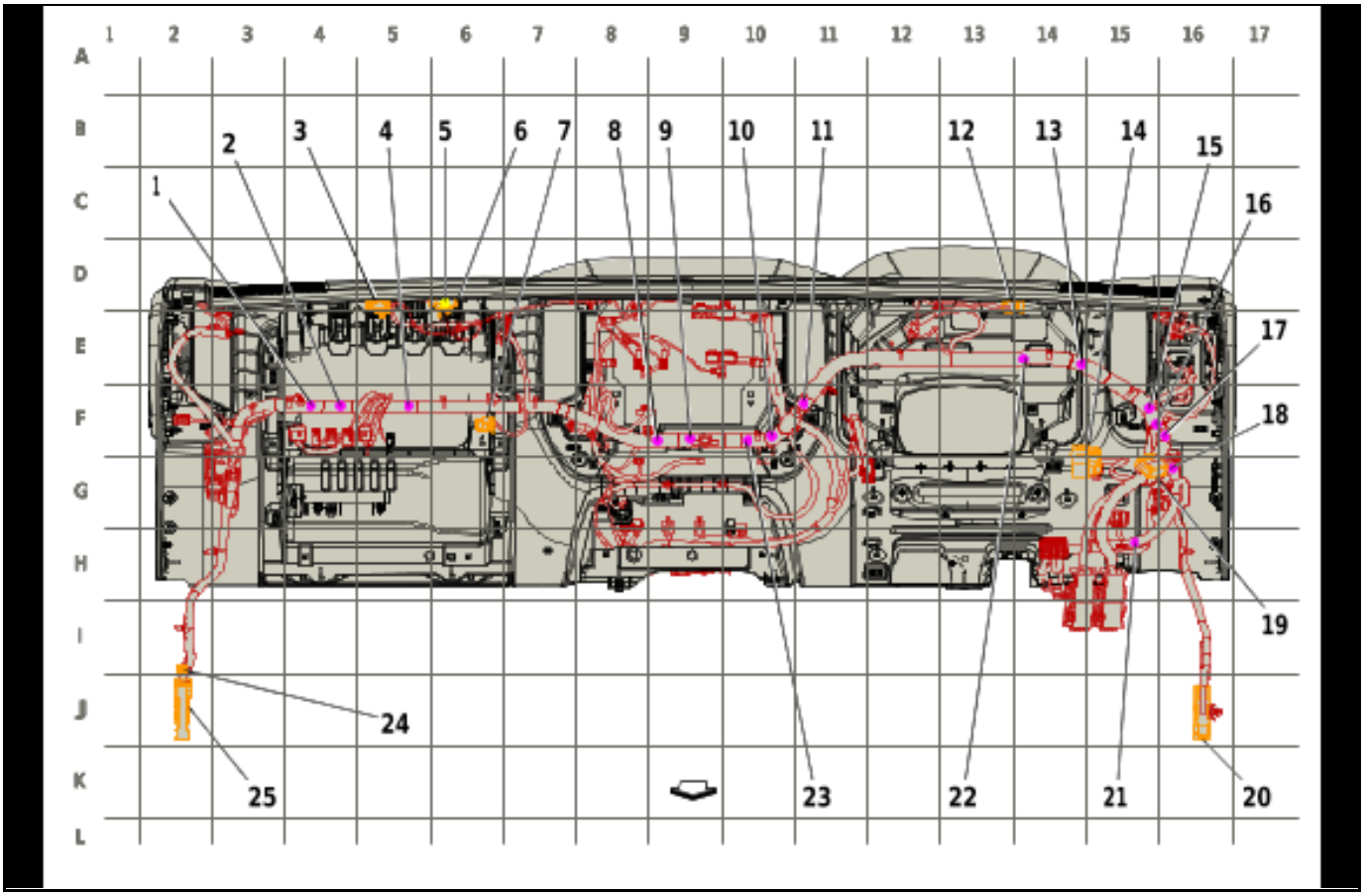
(1) X309 Floor Console USB Harness to Instrumental Panel USB Harness (D07)

(2) X300 Instrument Panel Wiring Harness to Front Floor Console Wiring Harness (D07)

(3) X302 Front Floor Console Wiring Harness Extension Harness to Front Floor Console Wiring Harness (K4C)

(4) J358 Front Floor Console Wiring Harness (D07)

Harness Routing Views (Instrument Panel Wiring Harness Routing (1WT))

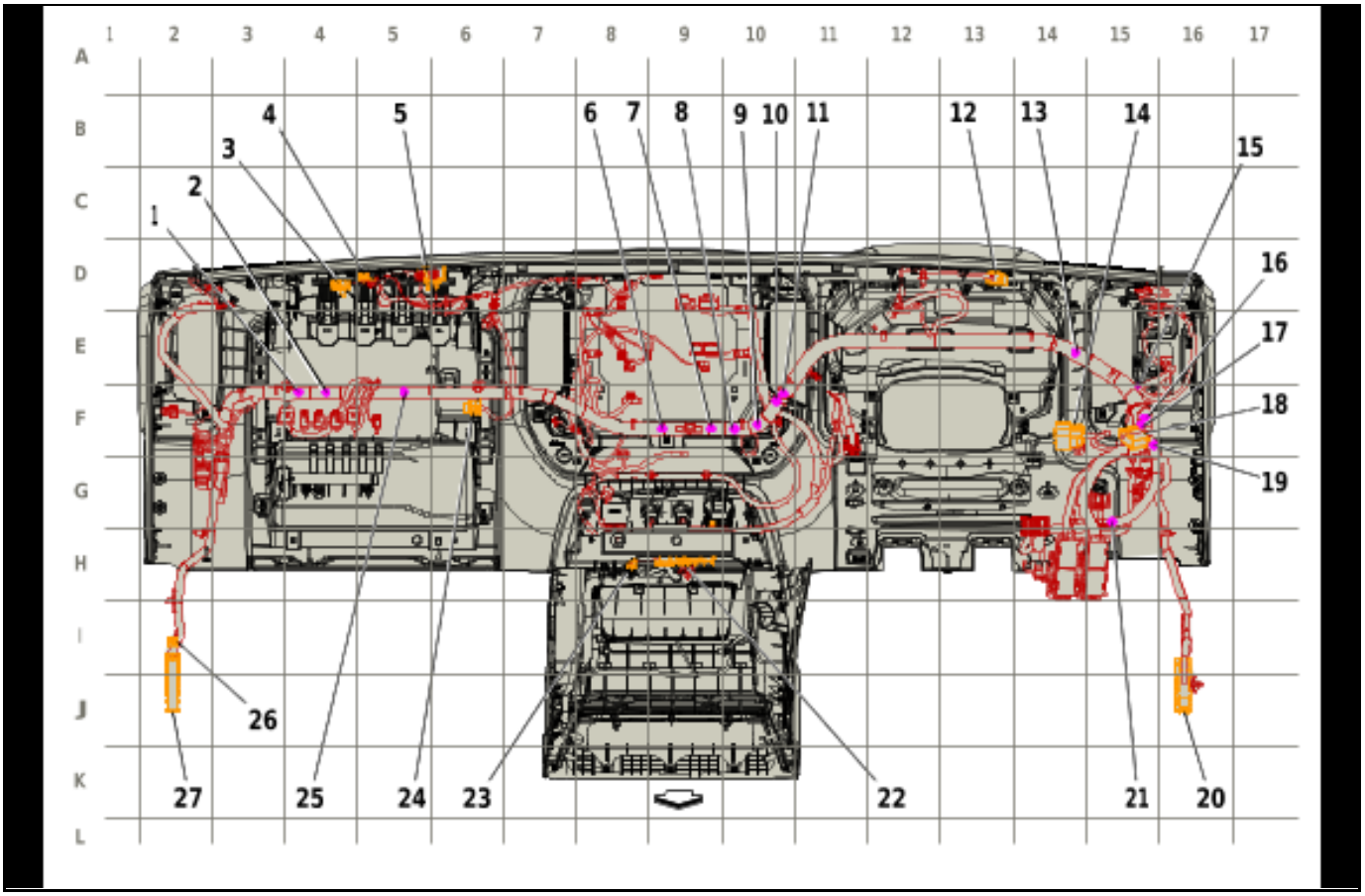


4975539

Items

(1) J241 Instrument Panel Wiring Harness
(2) J242 Instrument Panel Wiring Harness
(3) X222 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (UE1)
(4) J215 Instrument Panel Wiring Harness
(5) X210 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (U2K)
(6) X215 Air Conditioning Wiring Harness to Instrument Panel Wiring Harness
(7) X205 Instrument Panel Wiring Harness to Instrument Panel Wiring Harness Extension Wire
(8) J251 Instrument Panel Wiring Harness (IOB)
(9) J266 Instrument Panel Wiring Harness (IOB)
(10) J240 Instrument Panel Wiring Harness (D07/KI4)
(11) J289 Instrument Panel Wiring Harness
(12) X305 Instrument Panel Wiring Harness to Headlining Trim Panel Harness
(13) J205 Instrument Panel Wiring Harness
(14) X201 Steering Column Wiring Harness to Instrument Panel Wiring Harness
(15) J210 Instrument Panel Wiring Harness
(16) J200 Instrument Panel Wiring Harness
(17) J201 Instrument Panel Wiring Harness
(18) J212 Instrument Panel Wiring Harness
(19) JX200 Instrument Panel Wiring Harness
(20) X225 Body Wiring Harness to Instrument Panel Wiring Harness
(21) J211 Instrument Panel Wiring Harness
(22) J213 Instrument Panel Wiring Harness
(23) J290 Instrument Panel Wiring Harness (9L7/JPZ)
(24) X301 Body USB Harness to Instrumental Panel USB Harness (-D07)
(25) X275 Instrument Panel Wiring Harness to Body Wiring Harness

Harness Routing Views (Instrument Panel Wiring Harness Routing (1LT))

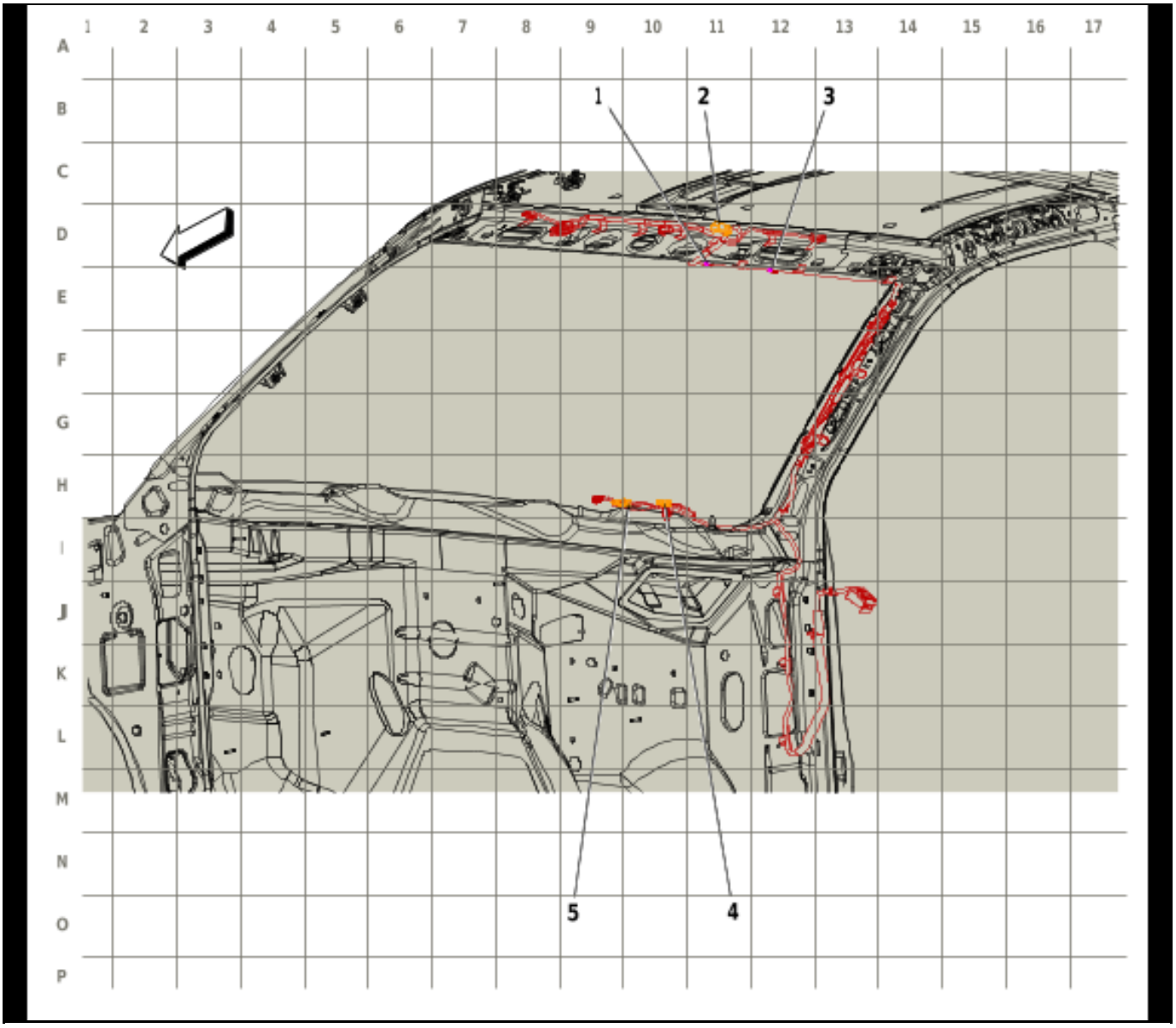


5909861

Items

(1) J241 Instrument Panel Wiring Harness
(2) J242 Instrument Panel Wiring Harness
(3) X210 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (U2K)
(4) X222 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (UE1)
(5) X215 Air Conditioning Wiring Harness to Instrument Panel Wiring Harness
(6) J249 Instrument Panel Wiring Harness (IO5)
(7) J220 Instrument Panel Wiring Harness
(8) J290 Instrument Panel Wiring Harness (9L7/JPZ)
(9) J240 Instrument Panel Wiring Harness (D07/KI4)
(10) J245 Instrument Panel Wiring Harness (KA1)
(11) J289 Instrument Panel Wiring Harness
(12) X305 Instrument Panel Wiring Harness to Headlining Trim Panel Harness
(13) J205 Instrument Panel Wiring Harness
(14) X201 Steering Column Wiring Harness to Instrument Panel Wiring Harness
(15) J213 Instrument Panel Wiring Harness
(16) J200 Instrument Panel Wiring Harness
(17) J201 Instrument Panel Wiring Harness
(18) JX200 Instrument Panel Wiring Harness
(19) J212 Instrument Panel Wiring Harness
(20) X225 Body Wiring Harness to Instrument Panel Wiring Harness
(21) J211 Instrument Panel Wiring Harness
(22) X300 Instrument Panel Wiring Harness to Front Floor Console Wiring Harness (D07)
(23) X309 Floor Console USB Harness to Instrumental Panel USB Harness (D07)
(24) X205 Instrument Panel Wiring Harness to Instrument Panel Wiring Harness Extension Wire
(25) J215 Instrument Panel Wiring Harness
(26) X301 Body USB Harness to Instrumental Panel USB Harness (-D07)
(27) X275 Instrument Panel Wiring Harness to Body Wiring Harness

Harness Routing Views (Roof Wiring Harness Routing)



4975544

Items

(1) J292 Roof Wiring Harness

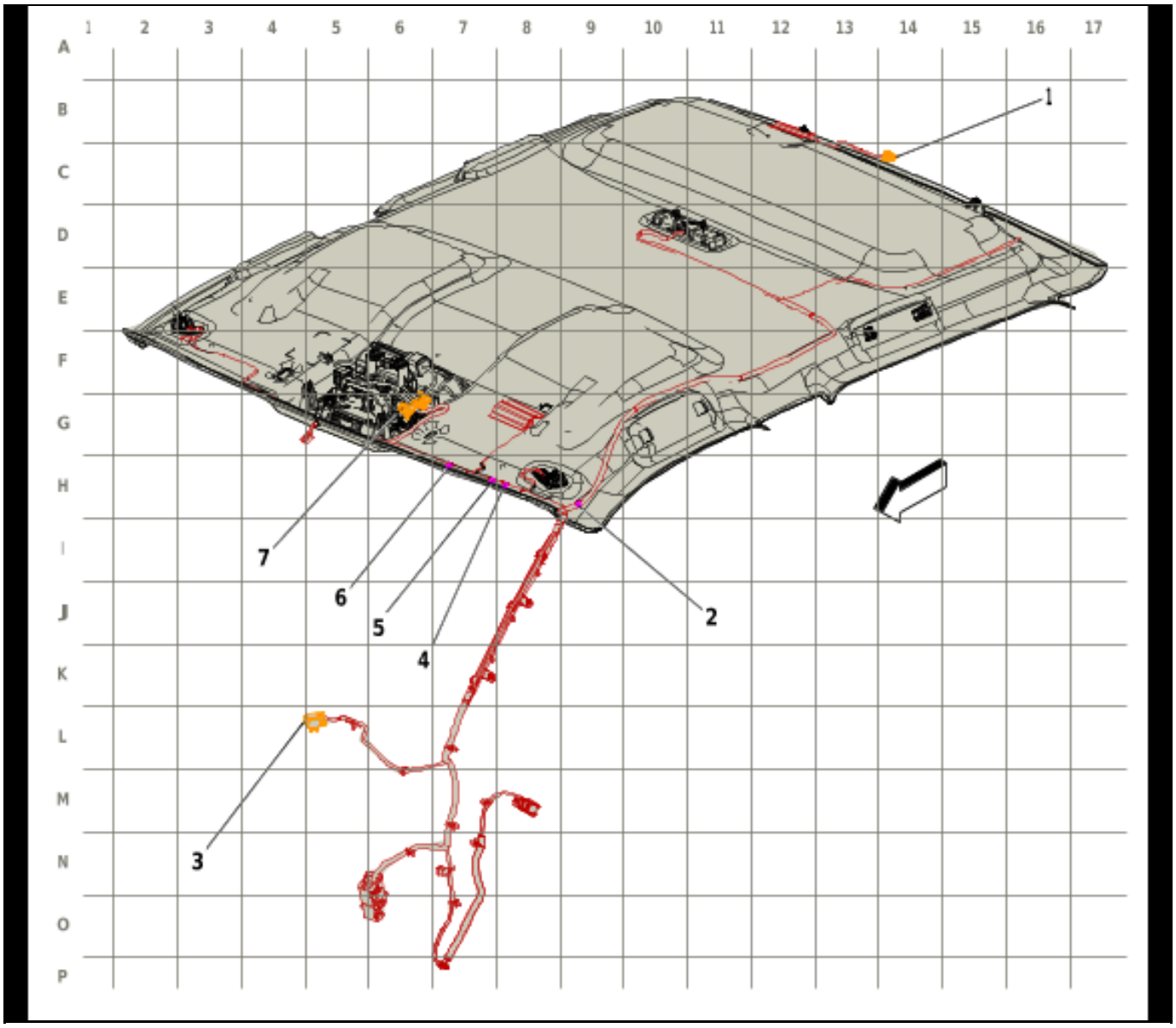
(2) X319 Roof Console Wiring Harness to Roof Wiring Harness (TRW)

(3) J293 Roof Wiring Harness

(4) X210 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (U2K)

(5) X222 Instrument Panel Coax Harness to Right A-Pillar Coax Harness (UE1)

Harness Routing Views (Headlining Trim Panel Harness Routing)



4975545

Items

(1) X317 Headlining Trim Panel Harness to CHMSL Wiring Harness

(2) J317 Headlining Trim Panel Harness (Crew Cab)

(3) X305 Instrument Panel Wiring Harness to Headlining Trim Panel Harness

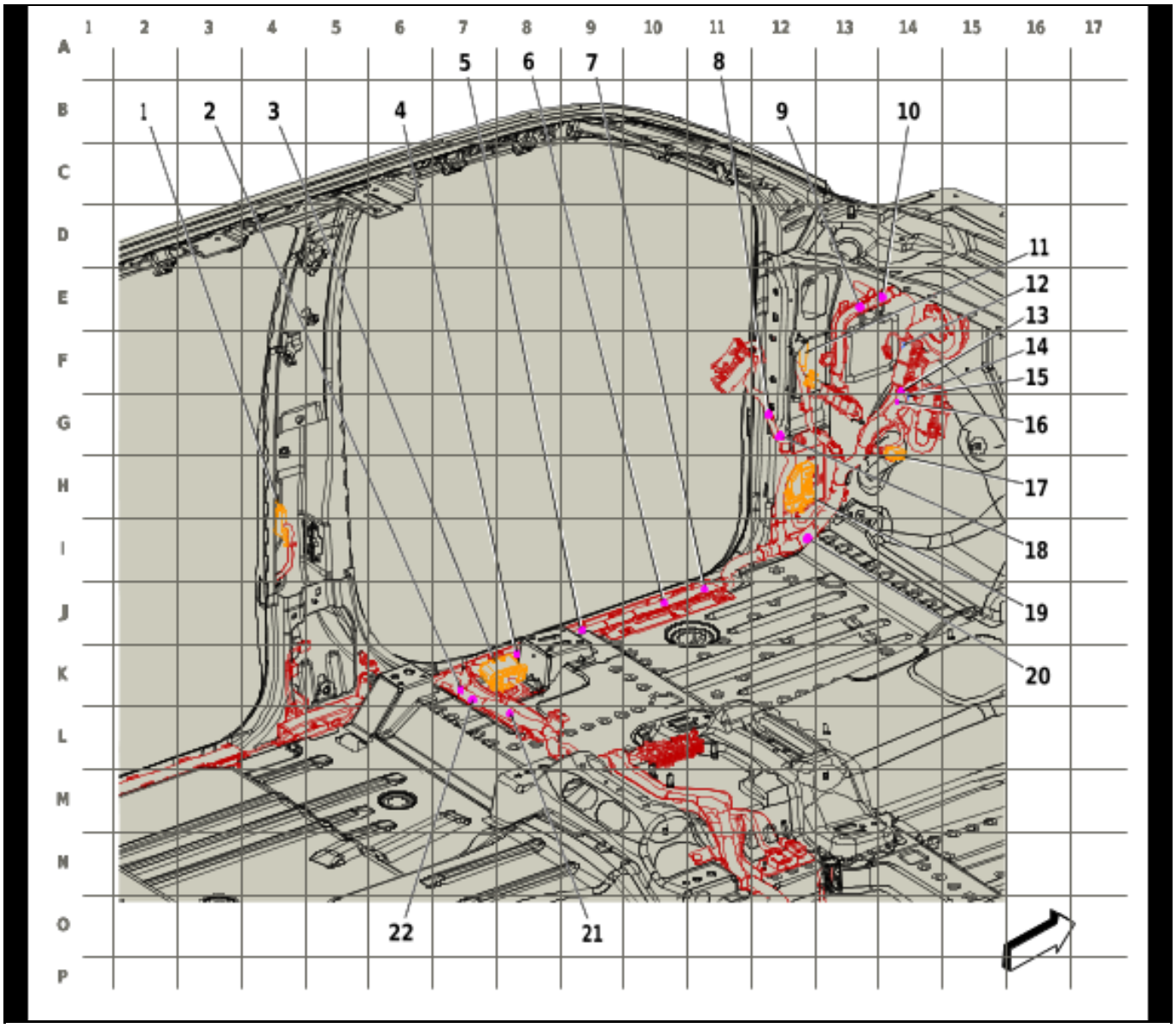
(4) J310 Headlining Trim Panel Harness (Crew Cab/DH6)

(5) J312 Headlining Trim Panel Harness (Crew Cab)

(6) J332 Headlining Trim Panel Harness

(7) X316 Headlining Trim Panel Harness to Roof Console Wiring Harness

Harness Routing Views (Body Wiring Harness Routing - Passenger Compartment Left)

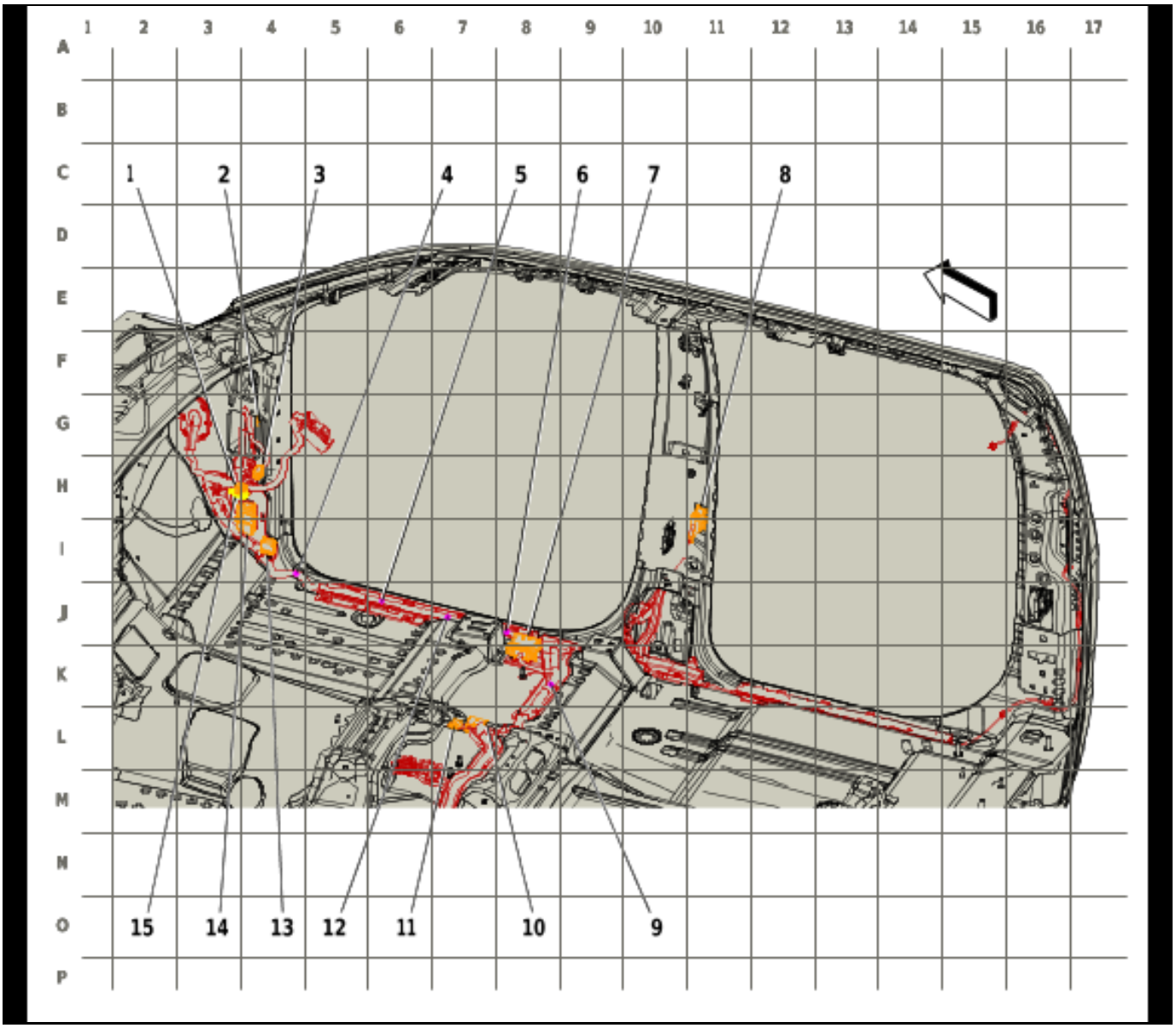


4992537

Items

(1) X700 Rear Side Door Door Wiring Harness - Left to Body Wiring Harness (Crew Cab)
(2) J350 Body Wiring Harness (IOB/UVC)
(3) X310 Front Seat Cushion Wiring Harness - Driver to Body Wiring Harness
(4) J365 Body Wiring Harness
(5) J309 Body Wiring Harness (JL1/NQF)
(6) J383 Body Wiring Harness
(7) J384 Body Wiring Harness (A31)
(8) J301 Body Wiring Harness
(9) J299 Body Wiring Harness (UY7)
(10) J357 Body Wiring Harness
(11) X500 Front Side Door Door Wiring Harness - Driver to Body Wiring Harness
(12) W33 Blunt Cut - Master Disconnect Switch Indicator Provision
(13) J300 Body Wiring Harness
(14) W31 Blunt Cut - Crank Inhibit Provision
(15) W32 Blunt Cut - Master Disconnect Switch Provision
(16) J302 Body Wiring Harness (DPN)
(17) X315 Body Wiring Harness to Auxiliary Fuse Block Wiring Harness
(18) J304 Body Wiring Harness
(19) X225 Body Wiring Harness to Instrument Panel Wiring Harness
(20) J367 Body Wiring Harness
(21) J360 Body Wiring Harness
(22) J370 Body Wiring Harness (Crew Cab)

Harness Routing Views (Body Wiring Harness Routing - Passenger Compartment Right)



4992539

Items

(1) X216 Body Wiring Harness to Air Conditioning Wiring Harness

(2) X600 Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness

(3) X217 Body Wiring Harness to Air Conditioning Wiring Harness

(4) J373 Body Wiring Harness

(5) J361 Body Wiring Harness (Crew Cab)

(6) J331 Body Wiring Harness (Crew Cab)

(7) X320 Front Seat Cushion Wiring Harness - Passenger to Body Wiring Harness

(8) X800 Rear Side Door Door Wiring Harness - Right to Body Wiring Harness (Crew Cab)

(9) J362 Body Wiring Harness (A52)

(10) X314 Front Seat Cushion Wiring Harness - Center to Body Wiring Harness (-D07)

(11) X313 Body USB Harness to Center Seat USB Harness (-D07)

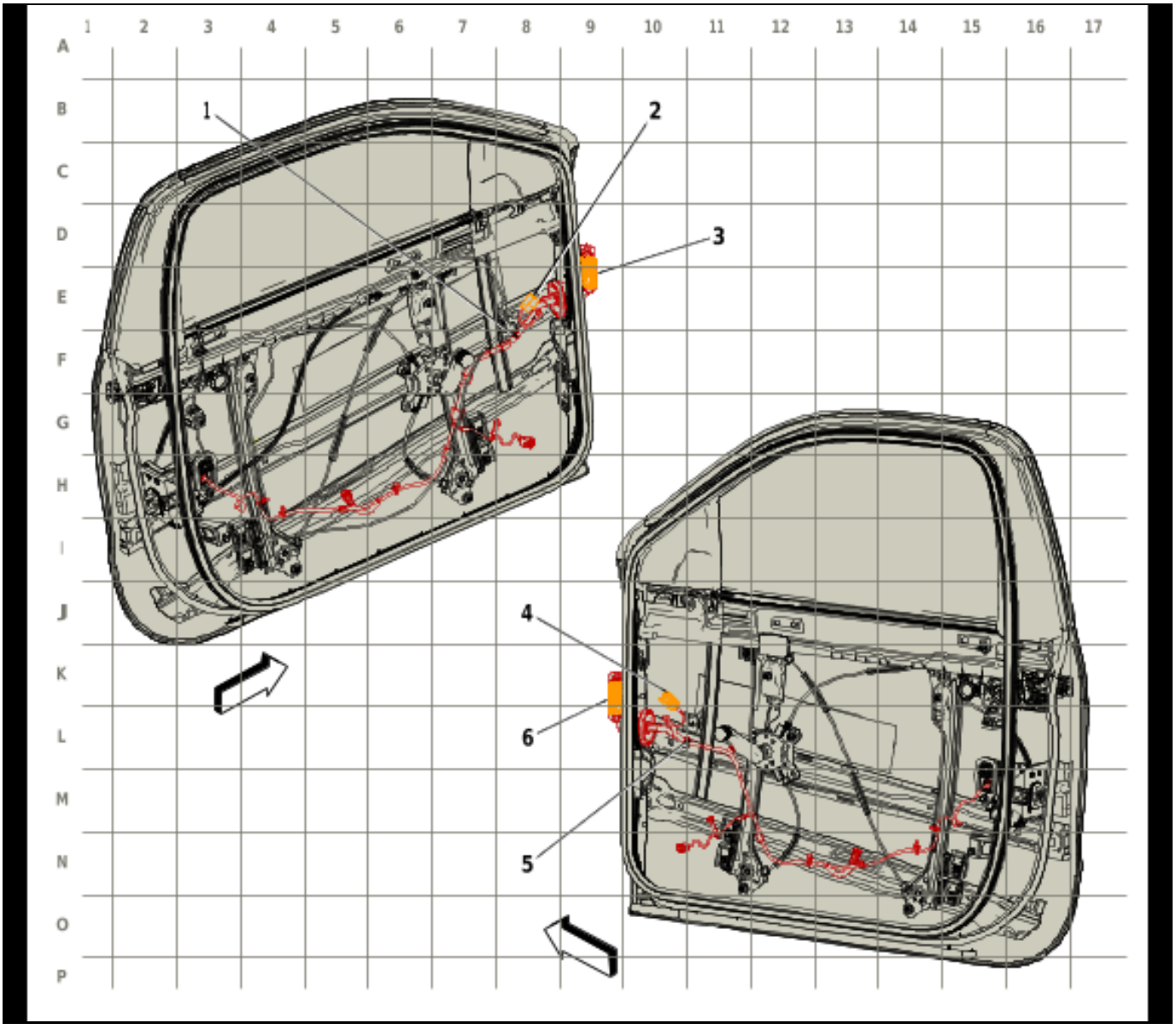
(12) J366 Body Wiring Harness (Crew Cab)

(13) JX300 Body Wiring Harness

(14) X275 Instrument Panel Wiring Harness to Body Wiring Harness

(15) X301 Body USB Harness to Instrumental Panel USB Harness (-D07)

Harness Routing Views (Front Side Door Door Wiring Harness - Driver and Front Side Door Door Wiring Harness - Passenger Routing (-A31))



4975547

Items

(1) J515 Front Side Door Door Wiring Harness - Driver

(2) X506 Front Side Door Door Lock Door Wiring Harness - Driver to Front Side Door Door Wiring Harness - Dri (-A31)

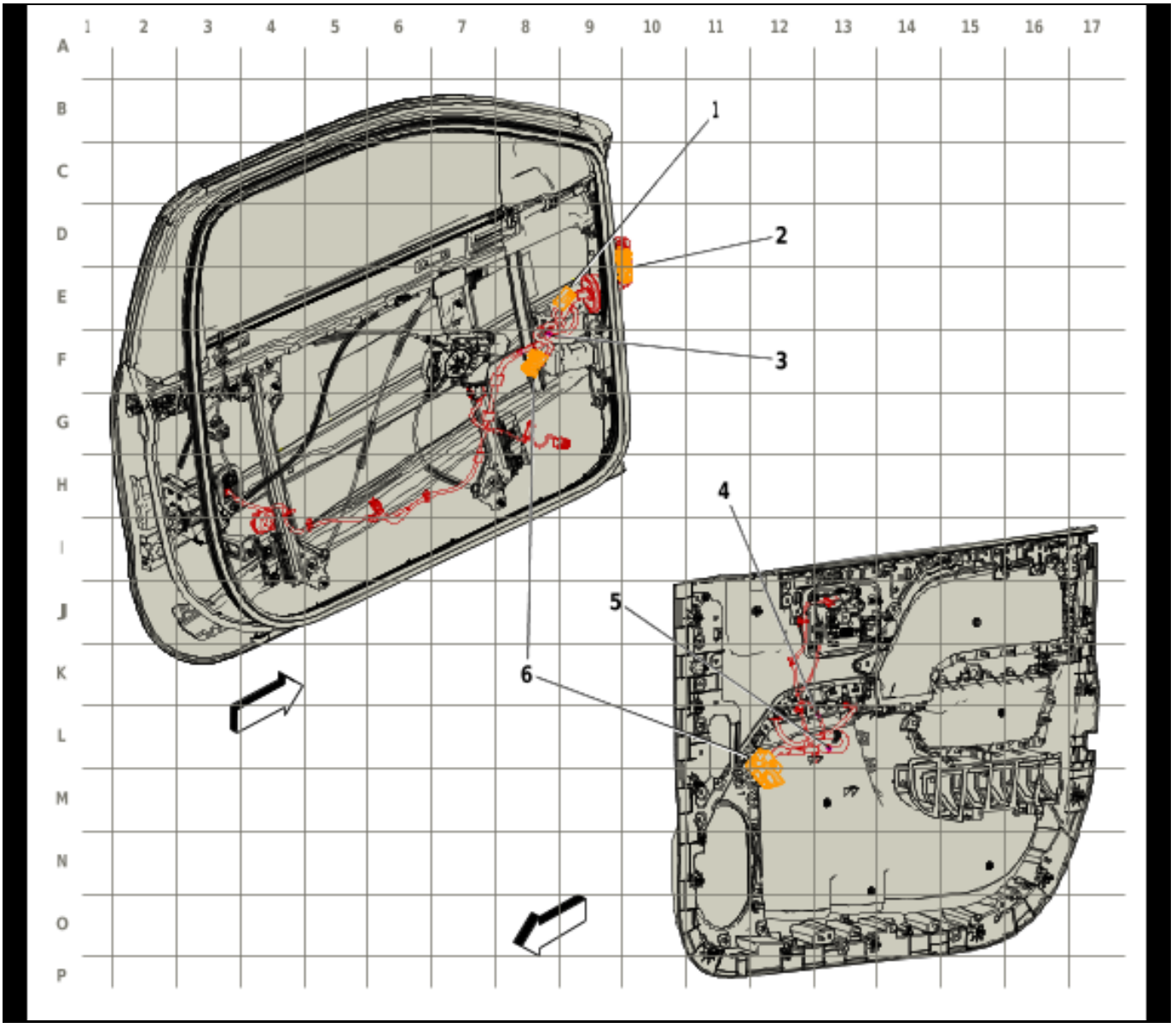
(3) X500 Front Side Door Door Wiring Harness - Driver to Body Wiring Harness

(4) X606 Front Side Door Door Lock Door Wiring Harness - Passenger to Front Side Door Door Wiring Harness - (-A31)

(5) J615 Front Side Door Door Wiring Harness - Passenger

(6) X600 Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness

Harness Routing Views (Front Side Door Door Wiring Harness - Driver and Front Side Door Door Lock Door Wiring Harness - Driver Routing (A31))



4975550

Items

(1) X510 Outside Rearview Mirror Wiring Harness - Driver to Front Side Door Door Wiring Harness - Driver (DPN)

(2) X500 Front Side Door Door Wiring Harness - Driver to Body Wiring Harness

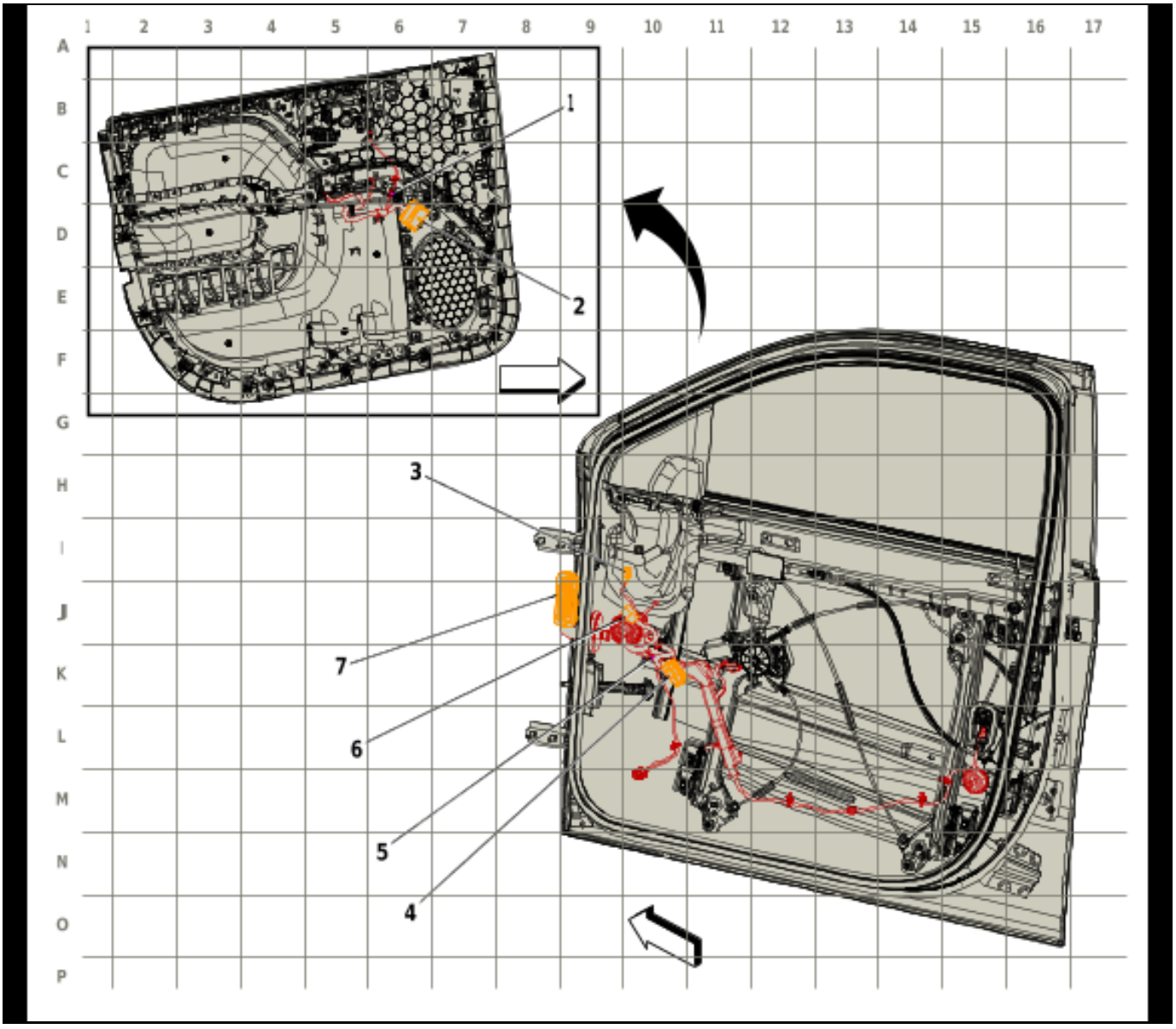
(3) J550 Front Side Door Door Wiring Harness - Driver (A31)

(4) J515 Front Side Door Door Wiring Harness - Driver

(5) J519 Front Side Door Door Lock Door Wiring Harness - Driver (DPN)

(6) X505 Front Side Door Door Wiring Harness - Driver to Front Side Door Door Lock Door Wiring Harness - Dri (A31)

Harness Routing Views (Front Side Door Door Wiring Harness - Passenger and Front Side Door Door Lock Door Wiring Harness - Passenger Routing (A31))



4975552

Items

(1) J615 Front Side Door Door Wiring Harness - Passenger

(2) X605 Front Side Door Door Wiring Harness - Passenger to Front Side Door Door Lock Door Wiring Harness - (A31)

(3) X611

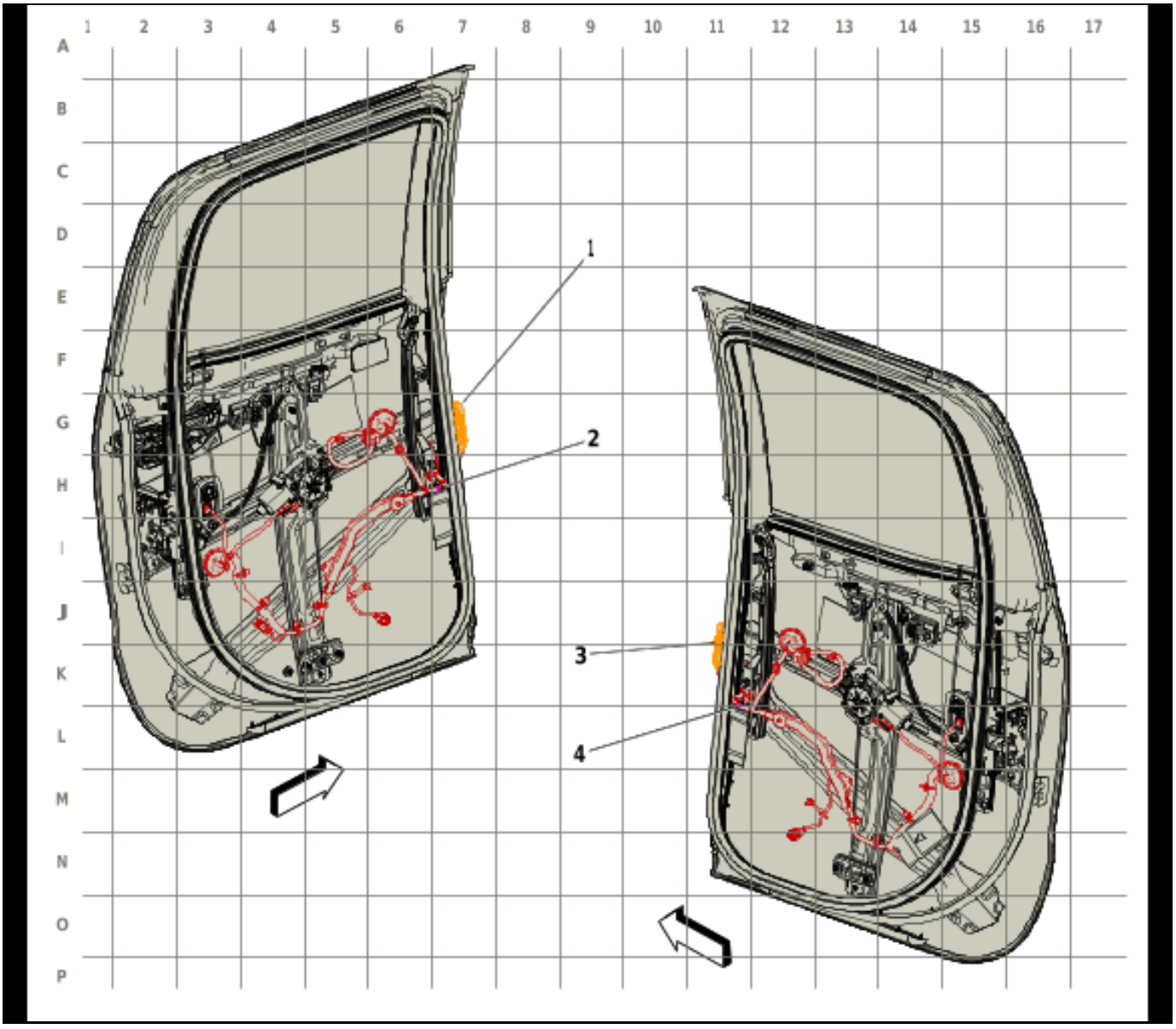
(4) X605 Front Side Door Door Wiring Harness - Passenger to Front Side Door Door Lock Door Wiring Harness - (A31)

(5) J615 Front Side Door Door Wiring Harness - Passenger

(6) X610 Outside Rearview Mirror Wiring Harness - Passenger to Front Side Door Door Wiring Harness - Passeng (DPN)

(7) X600 Front Side Door Door Wiring Harness - Passenger to Body Wiring Harness

Harness Routing Views (Rear Side Door Door Wiring Harness - Left and Rear Side Door Door Wiring Harness - Right Routing (Crew Cab))



4975554

Items

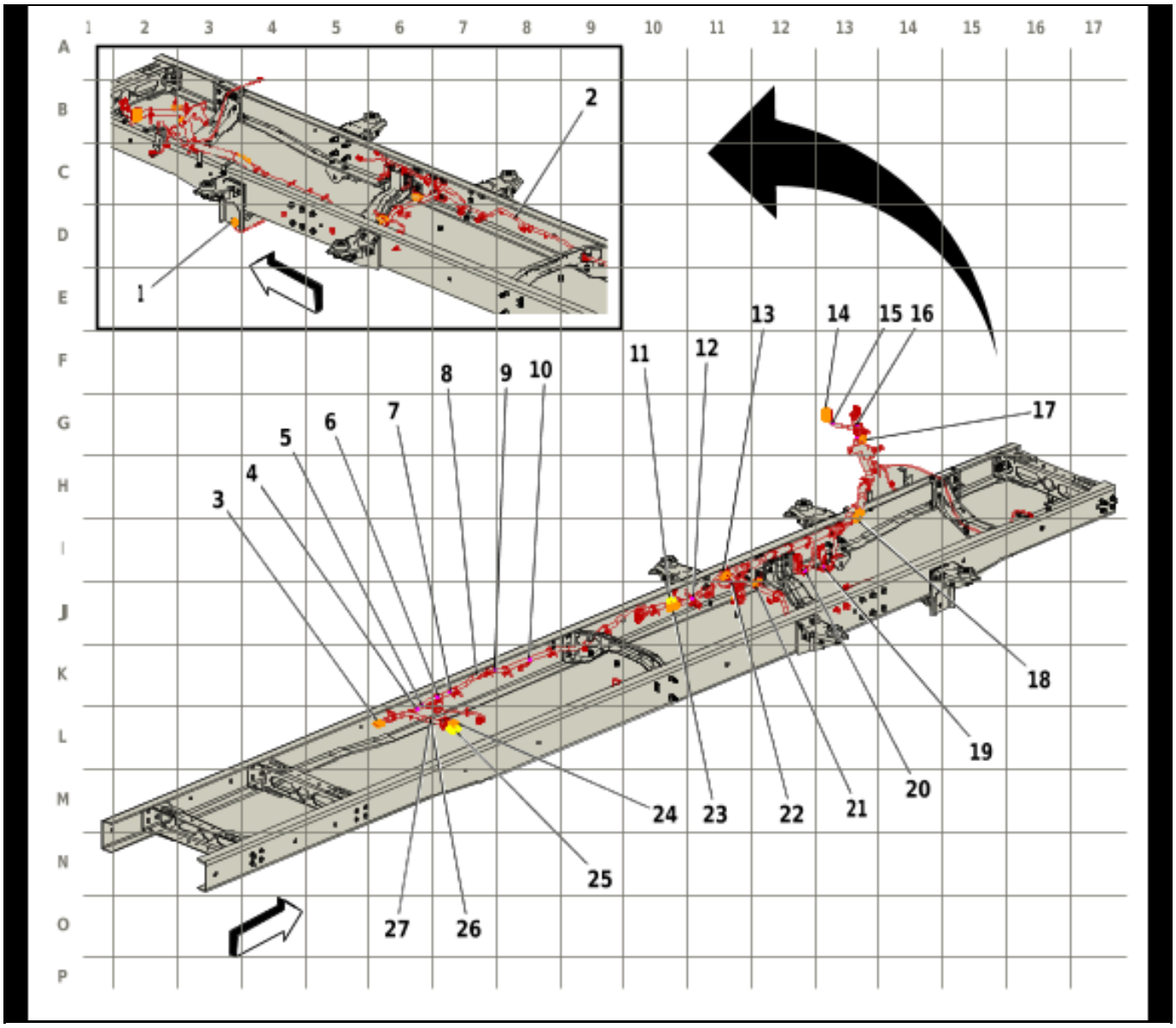
(1) X700 Rear Side Door Door Wiring Harness - Left to Body Wiring Harness (Crew Cab)

(2) J715 Rear Side Door Door Wiring Harness - Left (Crew Cab)

(3) X800 Rear Side Door Door Wiring Harness - Right to Body Wiring Harness (Crew Cab)

(4) J815 Rear Side Door Door Wiring Harness - Right (Crew Cab)

Harness Routing Views (Chassis Front Wiring Harness Routing)



5739167

Items

(1) X330 Chassis Front Wiring Harness to Battery Feed (7Y7/7Y8)

(2) J490 Chassis Front Wiring Harness

(3) X401 Chassis Rear Wiring Harness - Left to Chassis Front Wiring Harness

(4) J417 Chassis Front Wiring Harness (NSQ)

(5) J418 Chassis Front Wiring Harness (N2L)

(6) J420 Chassis Front Wiring Harness (5DX/5DY)

(7) J421 Chassis Front Wiring Harness (5DX/5DY)

(8) J422 Chassis Front Wiring Harness (5DX/5DY/DPN)

(9) J423 Chassis Front Wiring Harness (5DX/5DY)

(10) J400 Chassis Front Wiring Harness

(11) X430

(12) J411 Chassis Front Wiring Harness (5DX/5DY)

(13) JX301 Chassis Front Wiring Harness

(14) X138 Chassis Front Wiring Harness to Body Wiring Harness

(15) J138 Chassis Front Wiring Harness (UVC)

(16) J139 Chassis Front Wiring Harness

(17) X180 Brake Pedal Position Sensor Harness to Chassis Front Wiring Harness

(18) X125 Engine Wiring Harness - Chassis to Chassis Front Wiring Harness

(19) J397 Chassis Front Wiring Harness

(20) J398 Chassis Front Wiring Harness

(21) JX302 Chassis Front Wiring Harness

(22) J399 Chassis Front Wiring Harness

(23) X405

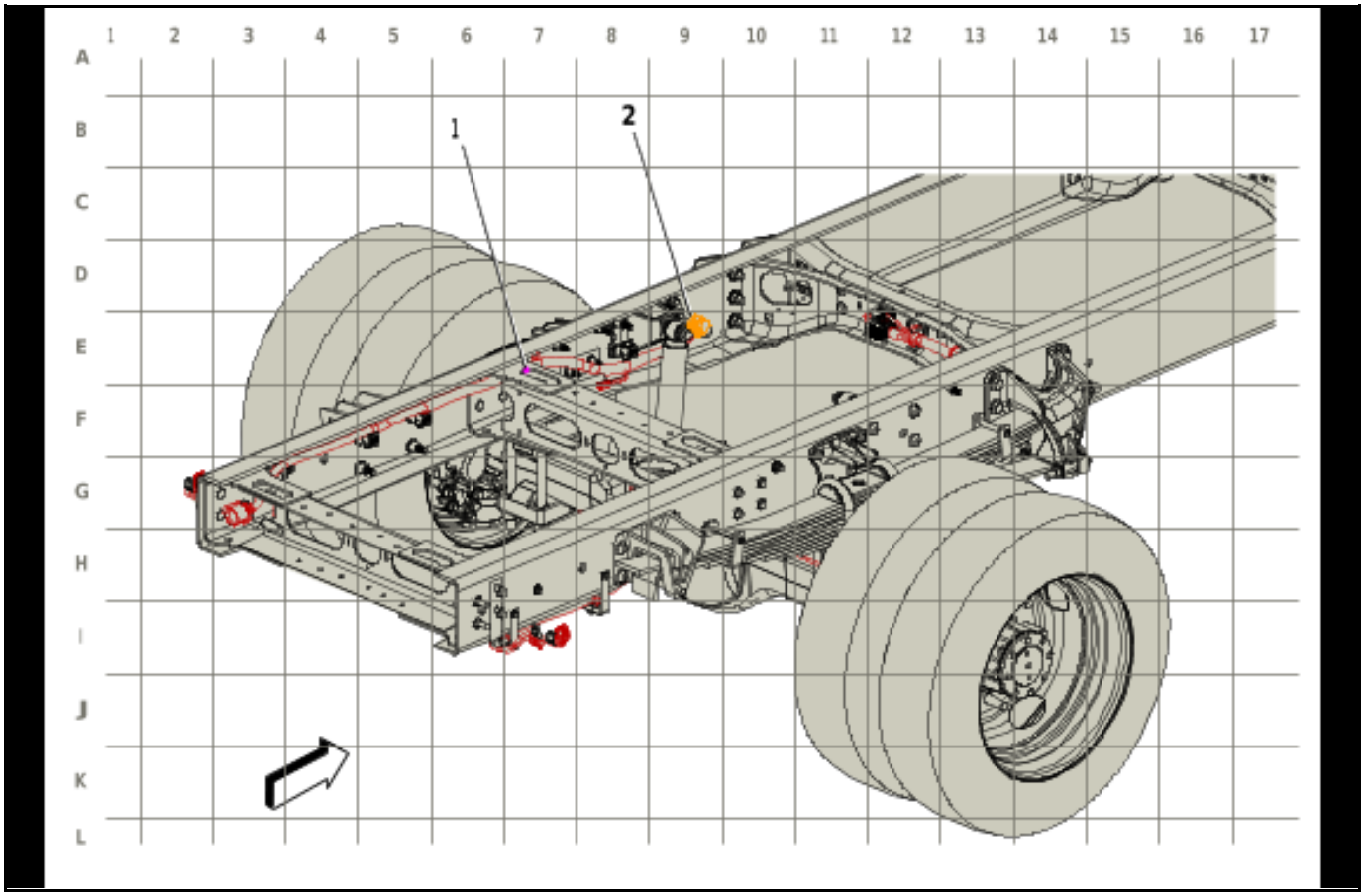
(24) X455 Chassis Front Wiring Harness to Chassis Rear Wiring Harness - Right (5DY)

(25) X402 Chassis Rear Wiring Harness - Right to Chassis Front Wiring Harness

(26) J401 Chassis Front Wiring Harness (NSQ/NVK)

(27) J419 Chassis Front Wiring Harness (UVC)

Harness Routing Views (Chassis Rear Wiring Harness - Left Routing)



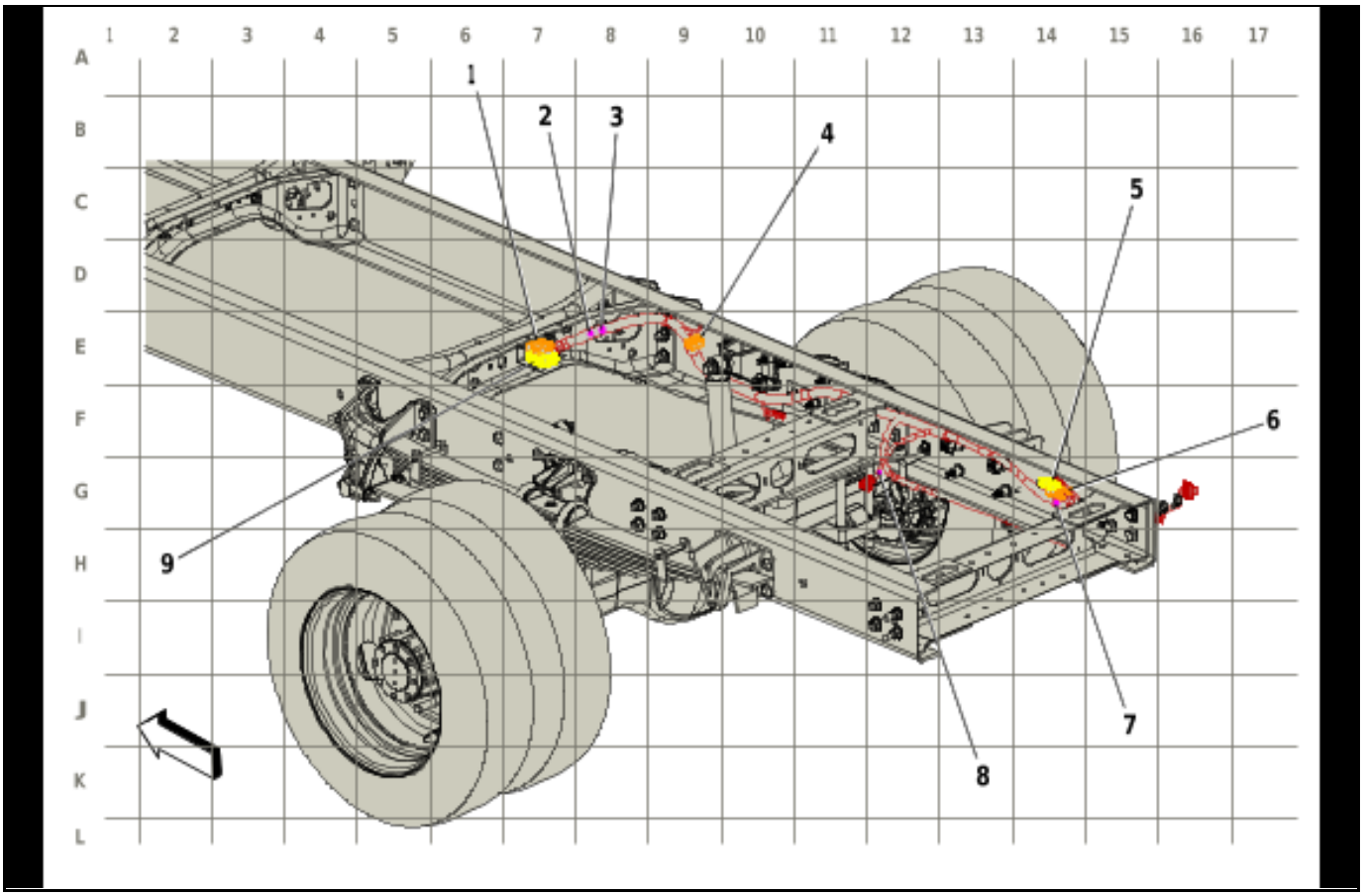
5278610

Items

(1) J450 Chassis Rear Wiring Harness - Left

(2) X401 Chassis Rear Wiring Harness - Left to Chassis Front Wiring Harness

Harness Routing Views (Chassis Rear Wiring Harness - Right Routing)



5278615

Items

(1) X455 Chassis Front Wiring Harness to Chassis Rear Wiring Harness - Right (5DY)

(2) J460 Chassis Rear Wiring Harness - Right (N2L)

(3) J461 Chassis Rear Wiring Harness - Right (UVC)

(4) JX402 Chassis Rear Wiring Harness - Right

(5) X499 Rearview Camera Wiring Harness to Chassis Rear Wiring Harness - Right (RWR/UVC)

(6) X495

(7) J462 Chassis Rear Wiring Harness - Right (UVC)

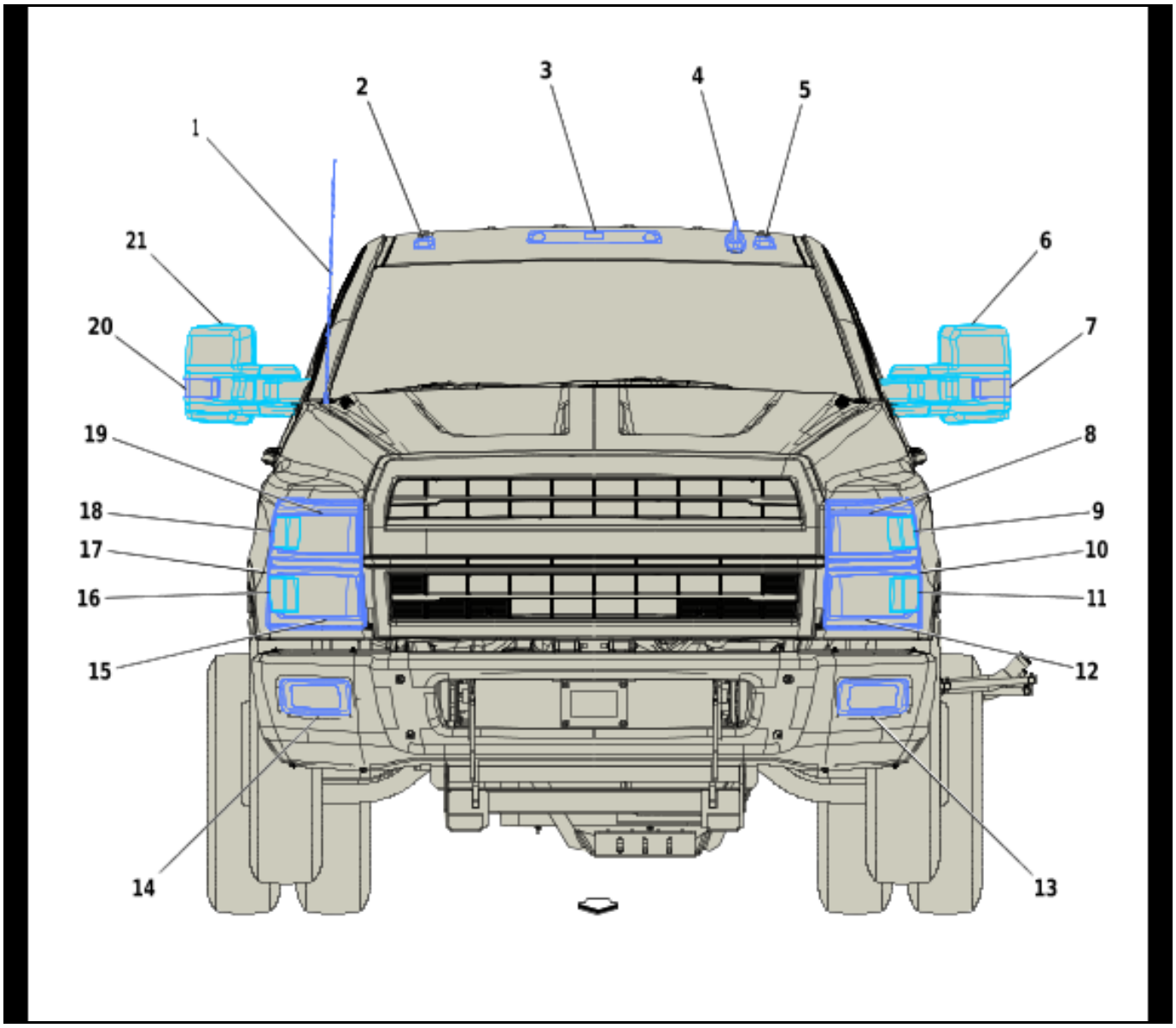
(8) J463 Chassis Rear Wiring Harness - Right (N2L)

(9) X402 Chassis Rear Wiring Harness - Right to Chassis Front Wiring Harness

Component Locator

Front of Vehicle/Engine Compartment Component Views

Front of Vehicle Components



4976265

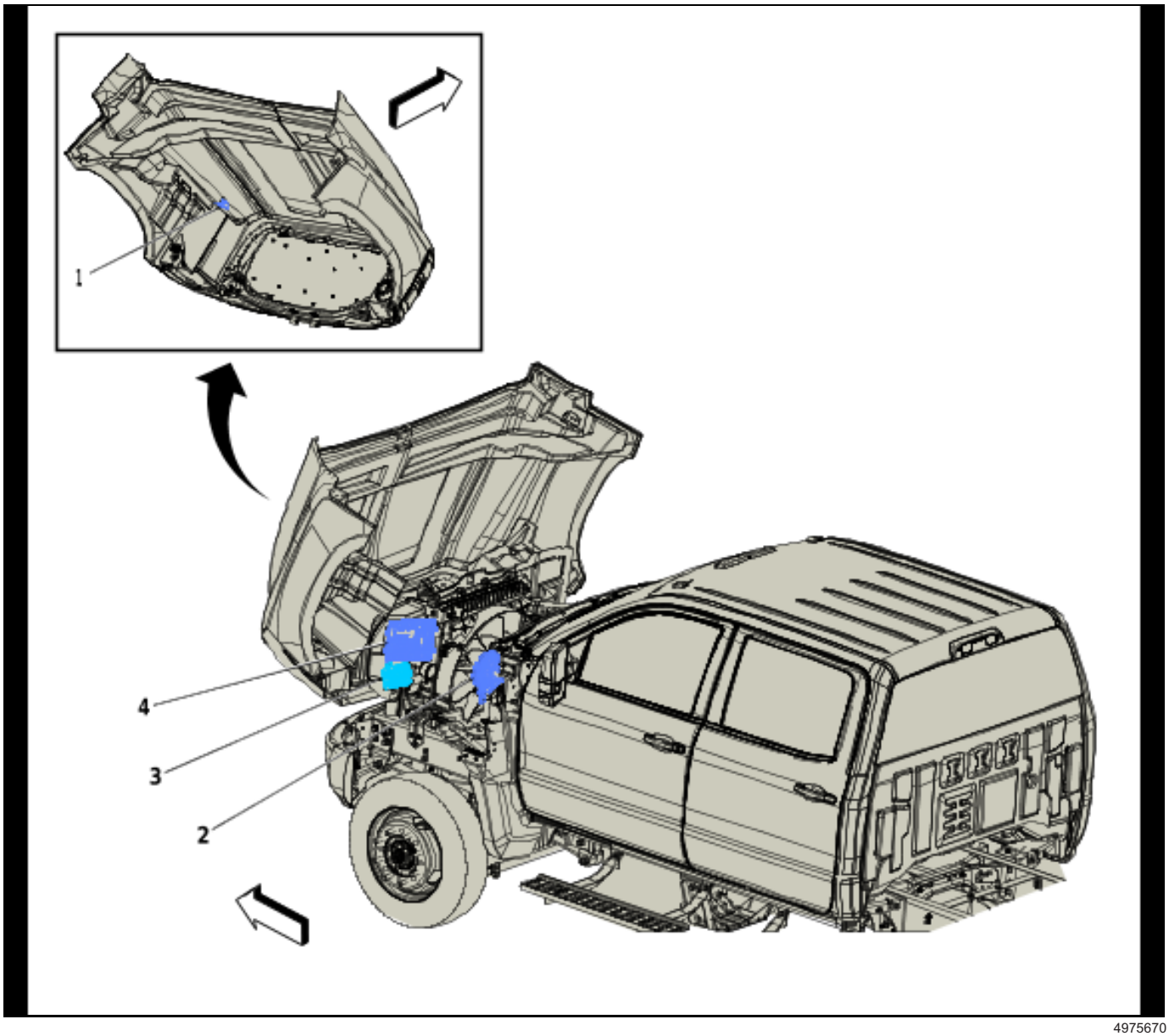
Items

(1) T4M Radio Antenna
(2) E3E Roof Clearance Lamp - Right Front Outer
(3) E3C Roof Clearance Lamp - Front Middle
(4) T2RF Antenna - Roof Front (U2K/UE1)
(5) E3A Roof Clearance Lamp - Left Front Outer
(6) A9A Outside Rearview Mirror - Driver
(7) E2LM Side Marker Lamp - Left Middle (DPN)
(8) E4G Headlamp - Left Low Beam
(9) E4S Park/Turn Signal Lamp - Left Upper
(10) E13LA Headlamp Assembly - Left
(11) E4Q Park/Turn Signal Lamp - Left Lower
(12) E4E Headlamp - Left High Beam
(13) E29LF Fog Lamp - Left Front (T3U)
(14) E29RF Fog Lamp - Right Front (T3U)
(15) E4F Headlamp - Right High Beam
(16) E4R Park/Turn Signal Lamp - Right Lower
(17) E13RA Headlamp Assembly - Right
(18) E4T Park/Turn Signal Lamp - Right Upper
(19) E4H Headlamp - Right Low Beam

(20) E2RM Side Marker Lamp - Right Middle (DPN)

(21) A9B Outside Rearview Mirror - Passenger

Radiator Support Components



4975670

Items

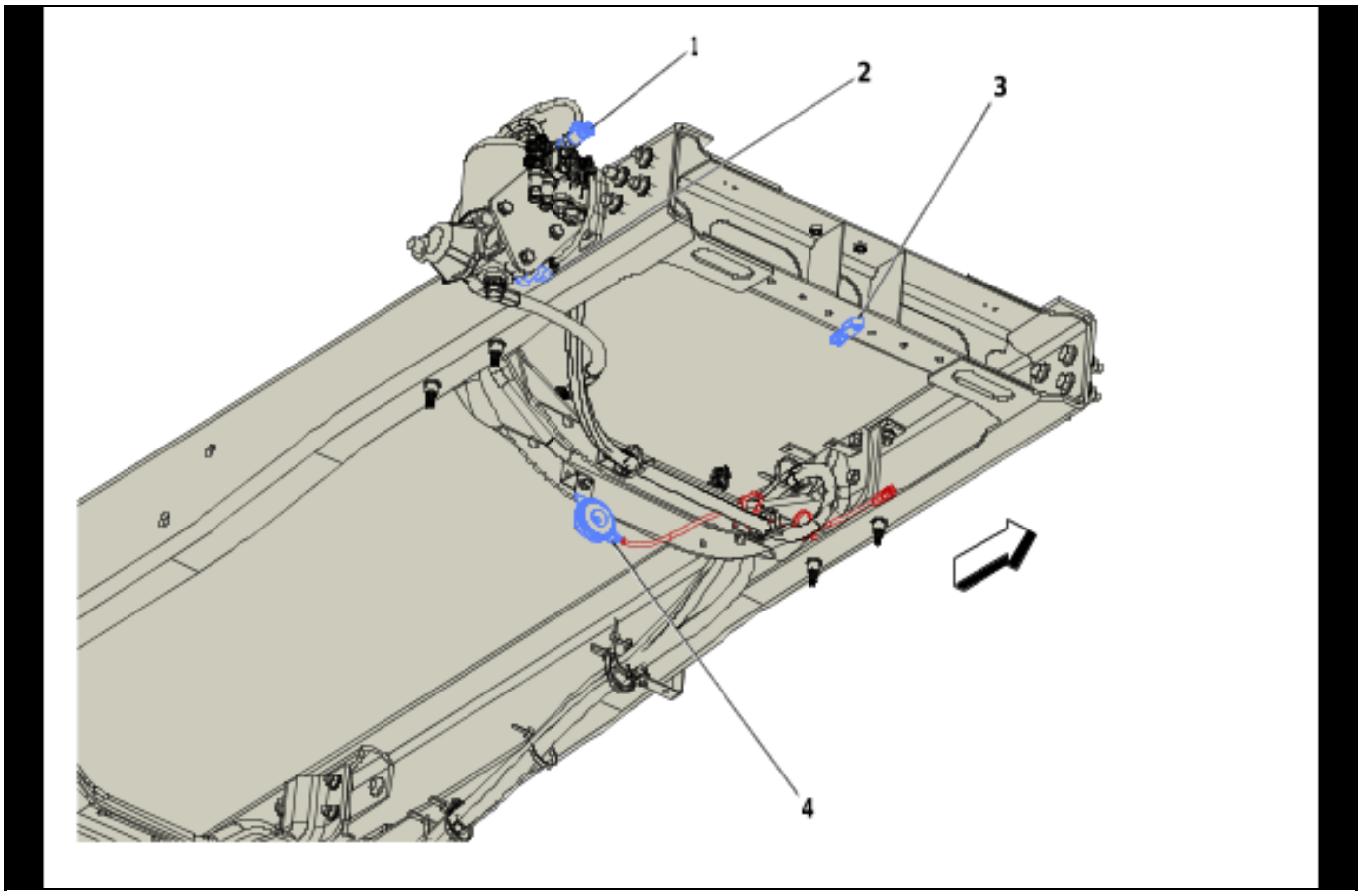
(1) B55 Engine Hood Switch (BTV/PTO/UTJ)

(2) Q85 Cooling Fan Clutch

(3) K71 Transmission Control Module

(4) K20 Engine Control Module

Front of Frame Components



4992541

Items

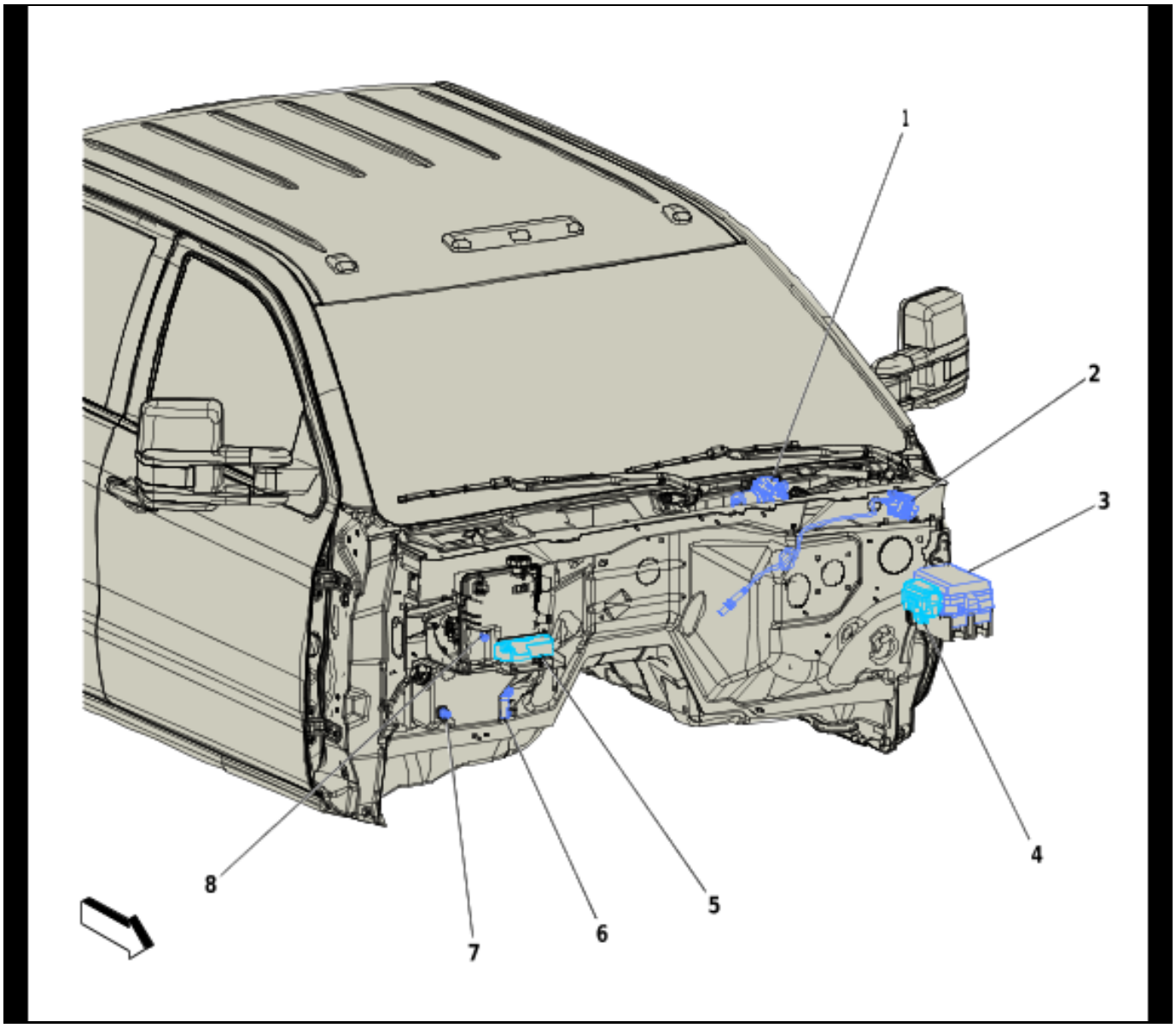
(1) B353 Air Suspension Low Pressure Warning Switch (G40/GP1/GP8)

(2) E91 Air Dryer Valve Heater (JPY)

(3) B59 Front Impact Sensor

(4) P12 Horn

Bulkhead Components - Engine Compartment

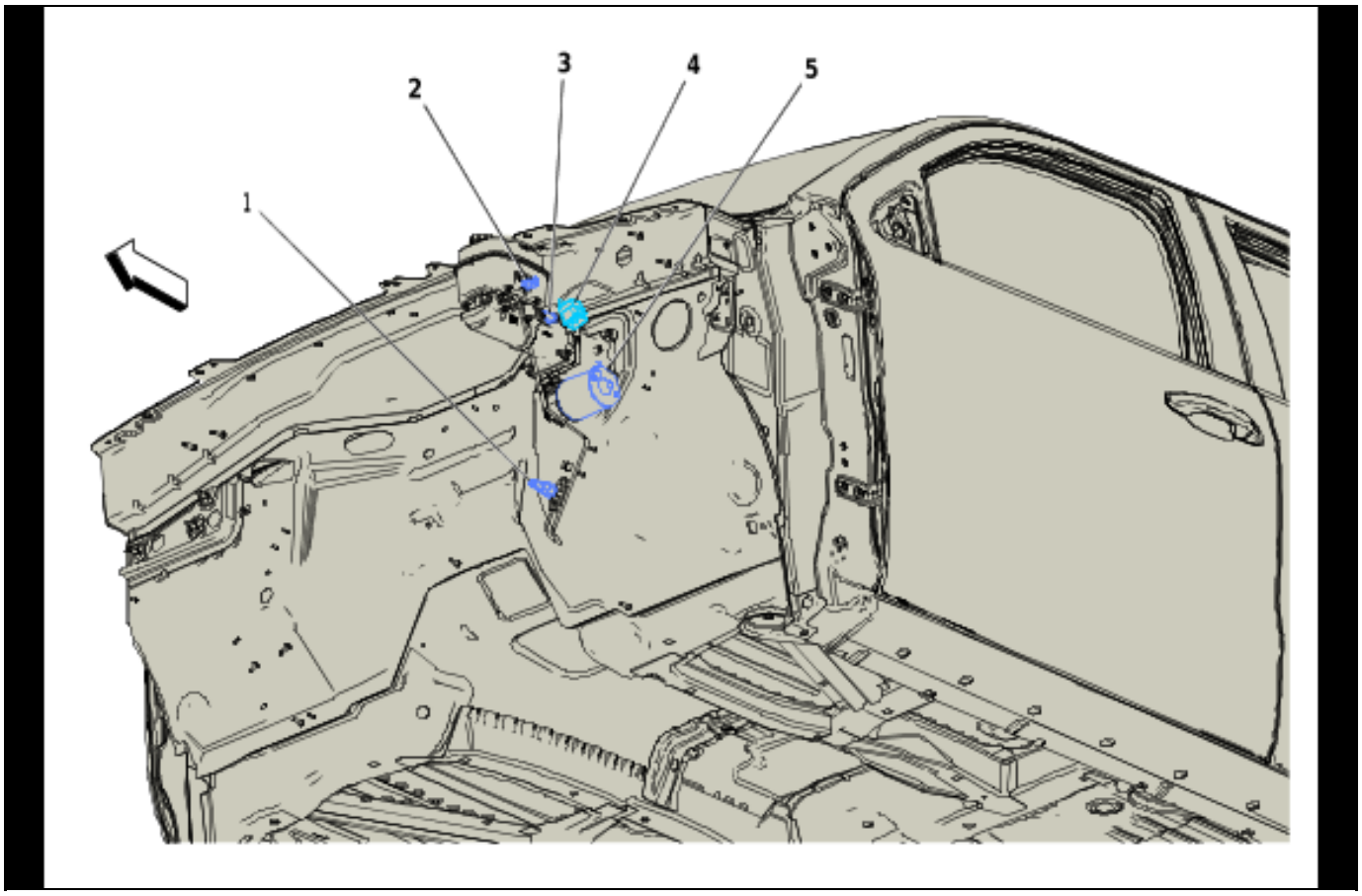


4992542

Items

(1) M75 Windshield Wiper Motor
(2) B195A Nitrogen Oxides Sensor 1
(3) X50A Fuse Block - Underhood
(4) X50B Fuse Block - Underhood Auxiliary
(5) X50D Fuse Block - Battery
(6) G24 Windshield Washer Pump
(7) B118B Windshield Washer Fluid Level Switch
(8) B33 Engine Coolant Level Switch

Brake Booster Components



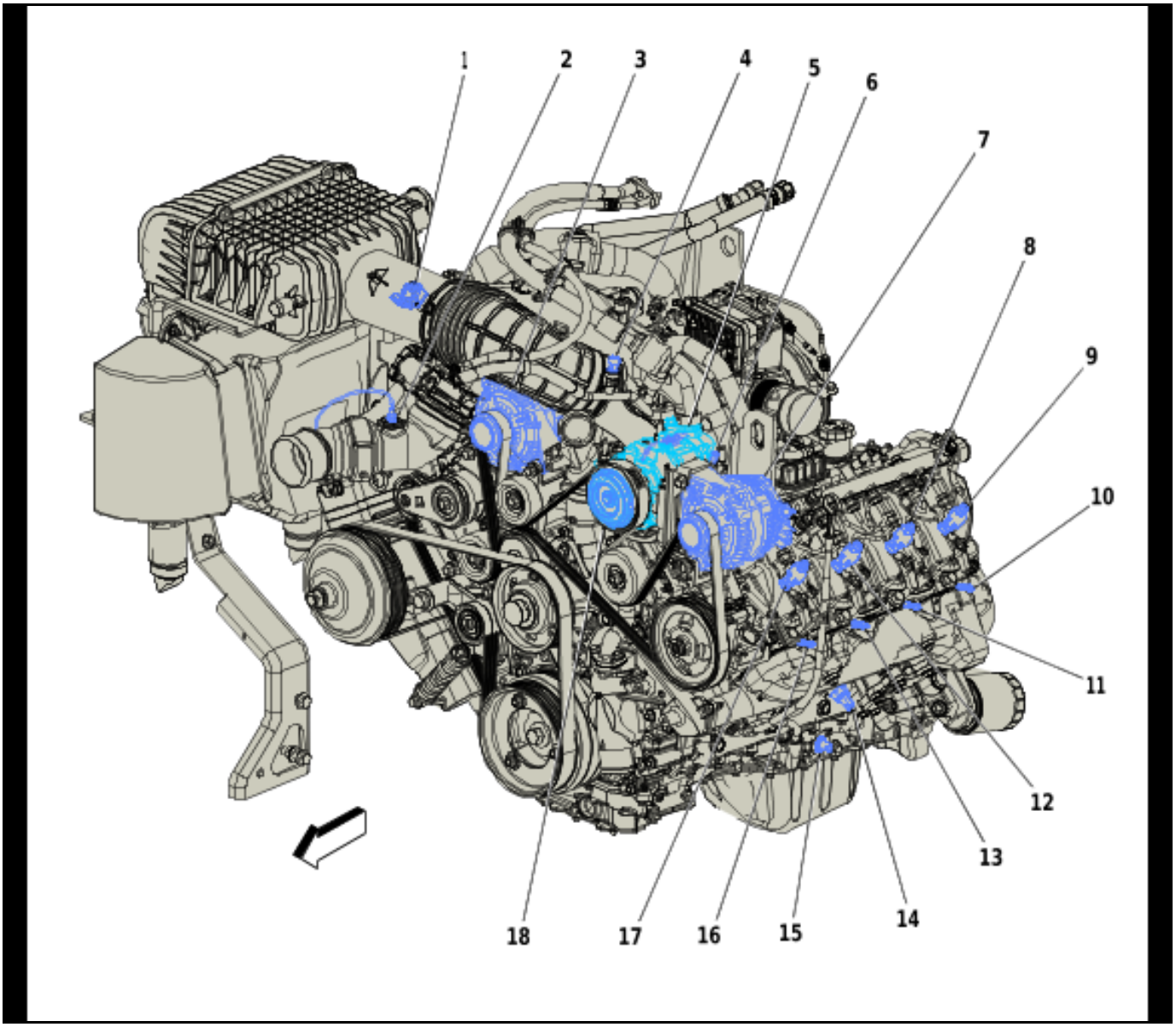
5619449

Items

(1) B356 Brake Pipe Pressure Switch
(2) B20 Brake Fluid Level Switch
(3) B343 Power Brake Booster Fluid Flow Switch
(4) KR14 Brake Booster Pump Motor Relay
(5) M9 Brake Booster Pump Motor

Powertrain Component Views

Left Front of Engine Components

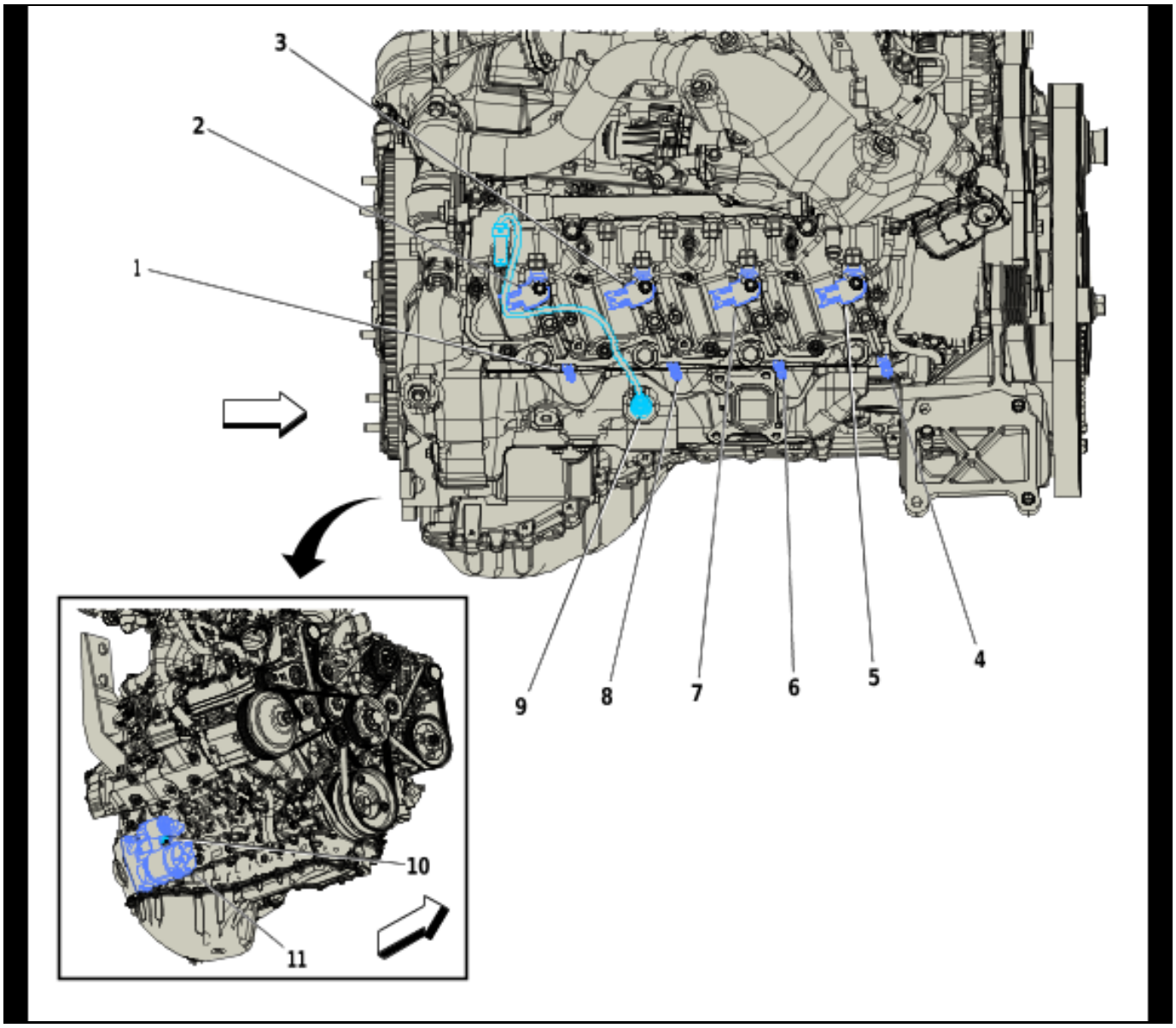


4975671

Items

(1) B75C Multifunction Intake Air Sensor
(2) B193B Charge Air Cooler Outlet Temperature Sensor
(3) G13 Generator
(4) B1 A/C Refrigerant Pressure Sensor
(5) G1 A/C Compressor
(6) Q46 A/C Compressor Solenoid Valve
(7) G13E Generator - Auxiliary (KHB)
(8) Q17F Fuel Injector 6
(9) Q17H Fuel Injector 8
(10) E12H Glow Plug 8
(11) E12F Glow Plug 6
(12) Q17D Fuel Injector 4
(13) E12D Glow Plug 4
(14) B37B Engine Oil Pressure Sensor
(15) B35 Engine Oil Level Switch
(16) E12B Glow Plug 2
(17) Q17B Fuel Injector 2
(18) Q2 A/C Compressor Clutch

Right Side of Engine Components

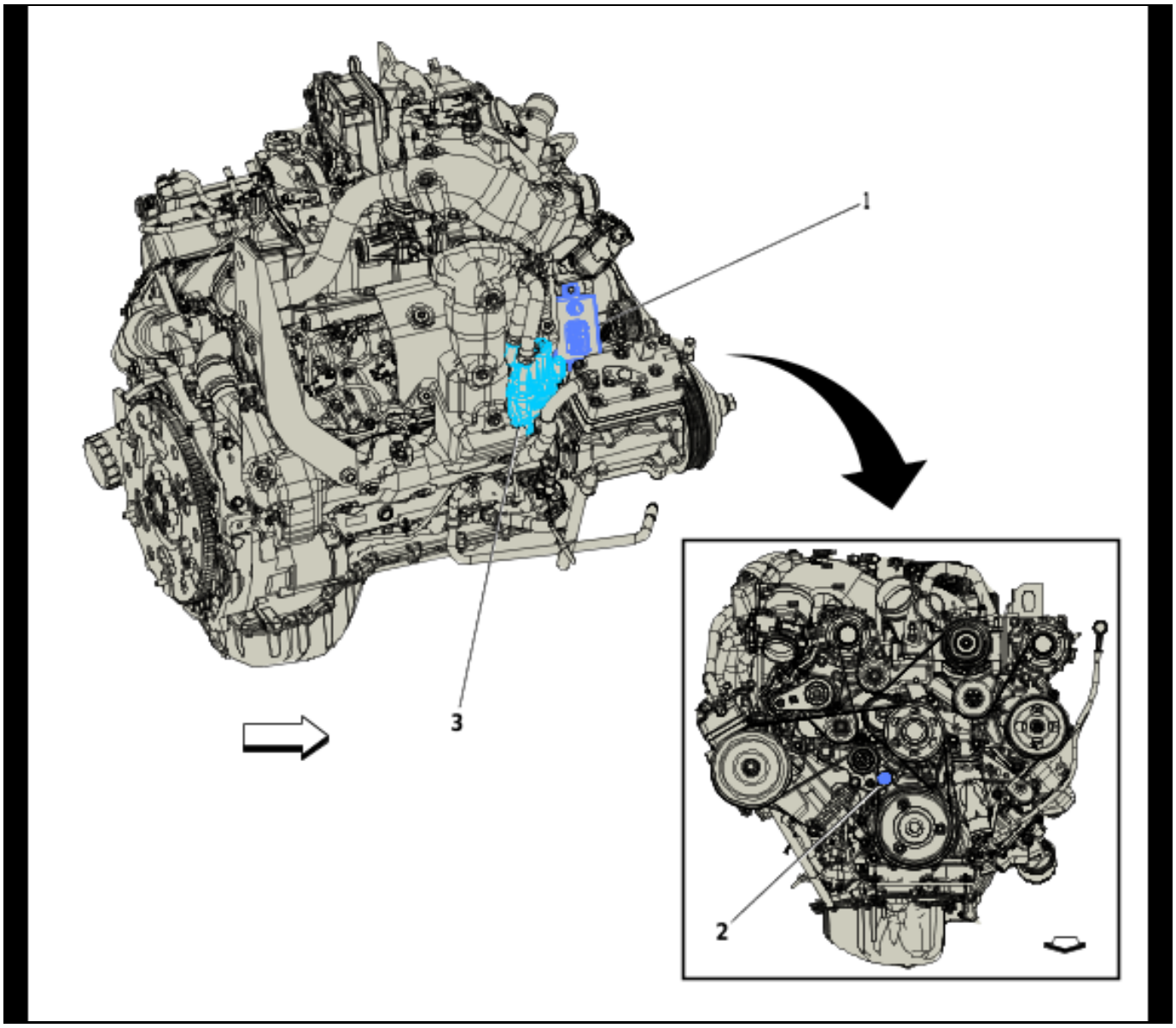


4975672

Items

(1) E12G Glow Plug 7
(2) Q17G Fuel Injector 7
(3) Q17E Fuel Injector 5
(4) E12A Glow Plug 1
(5) Q17A Fuel Injector 1
(6) E12C Glow Plug 3
(7) Q17C Fuel Injector 3
(8) E12E Glow Plug 5
(9) B130A Exhaust Gas Recirculation Temperature Sensor 1
(10) B26 Crankshaft Position Sensor
(11) M64 Starter Motor

Front of Engine Components

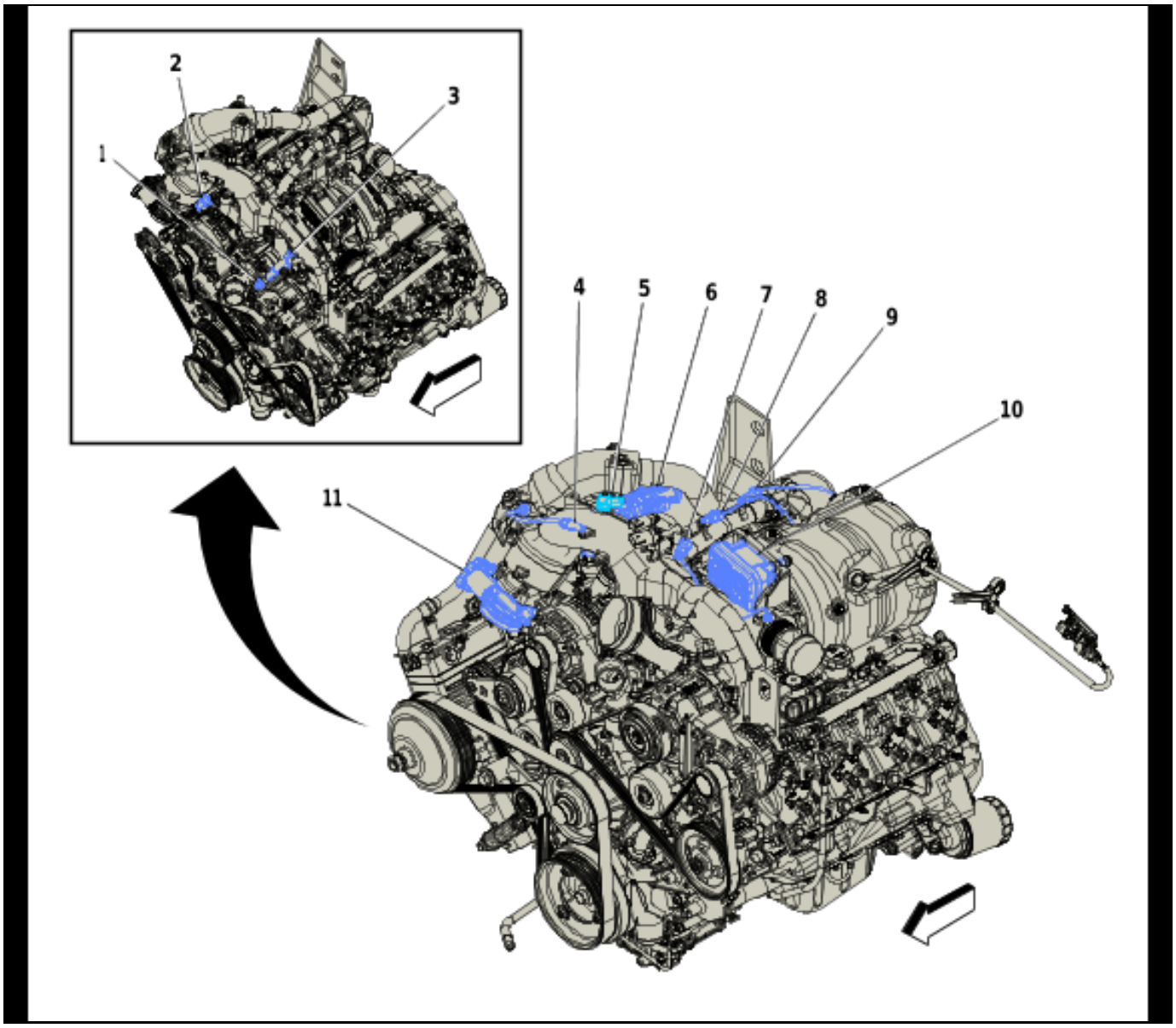


4975677

Items

(1) K34 Glow Plug Control Module
(2) B23 Camshaft Position Sensor
(3) Q14 Exhaust Gas Recirculation Valve

Top of Engine Components

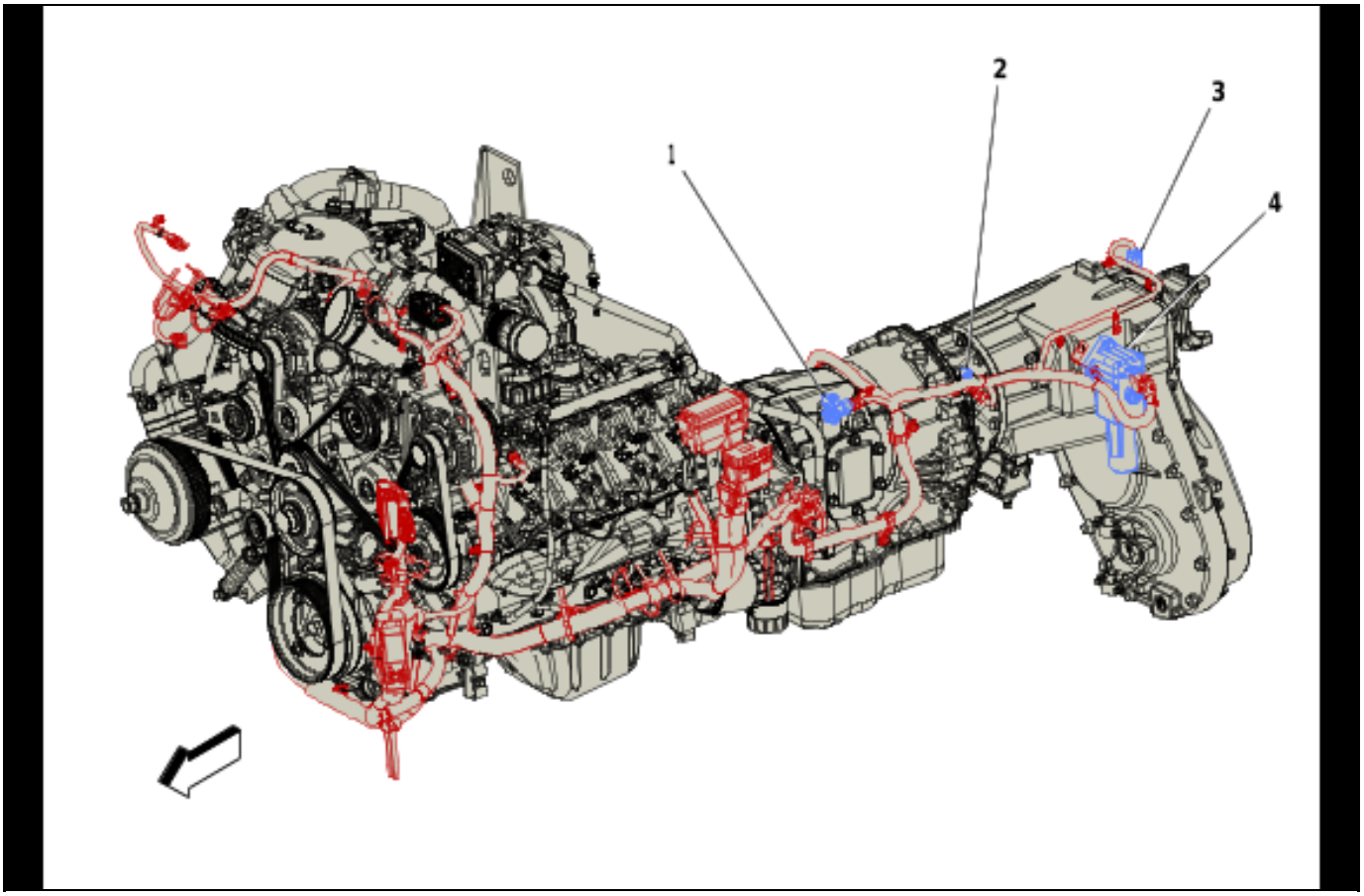


4975675

Items

(1) B34 Engine Coolant Temperature Sensor
(2) B47B Fuel Rail Pressure Sensor
(3) Q18A Fuel Pressure Regulator 1
(4) B130B Exhaust Gas Recirculation Temperature Sensor 2
(5) B65 Intake Manifold Pressure and Air Temperature Sensor
(6) M114 Exhaust Gas Recirculation Cooler Bypass Valve Actuator
(7) B193A Charge Air Cooler Inlet Temperature Sensor
(8) B131A Exhaust Temperature Sensor 1
(9) B131B Exhaust Temperature Sensor 2
(10) M103 Turbocharger Vane Position Actuator
(11) Q20 Intake Air Flow Valve

Transmission and Transfer Case Components



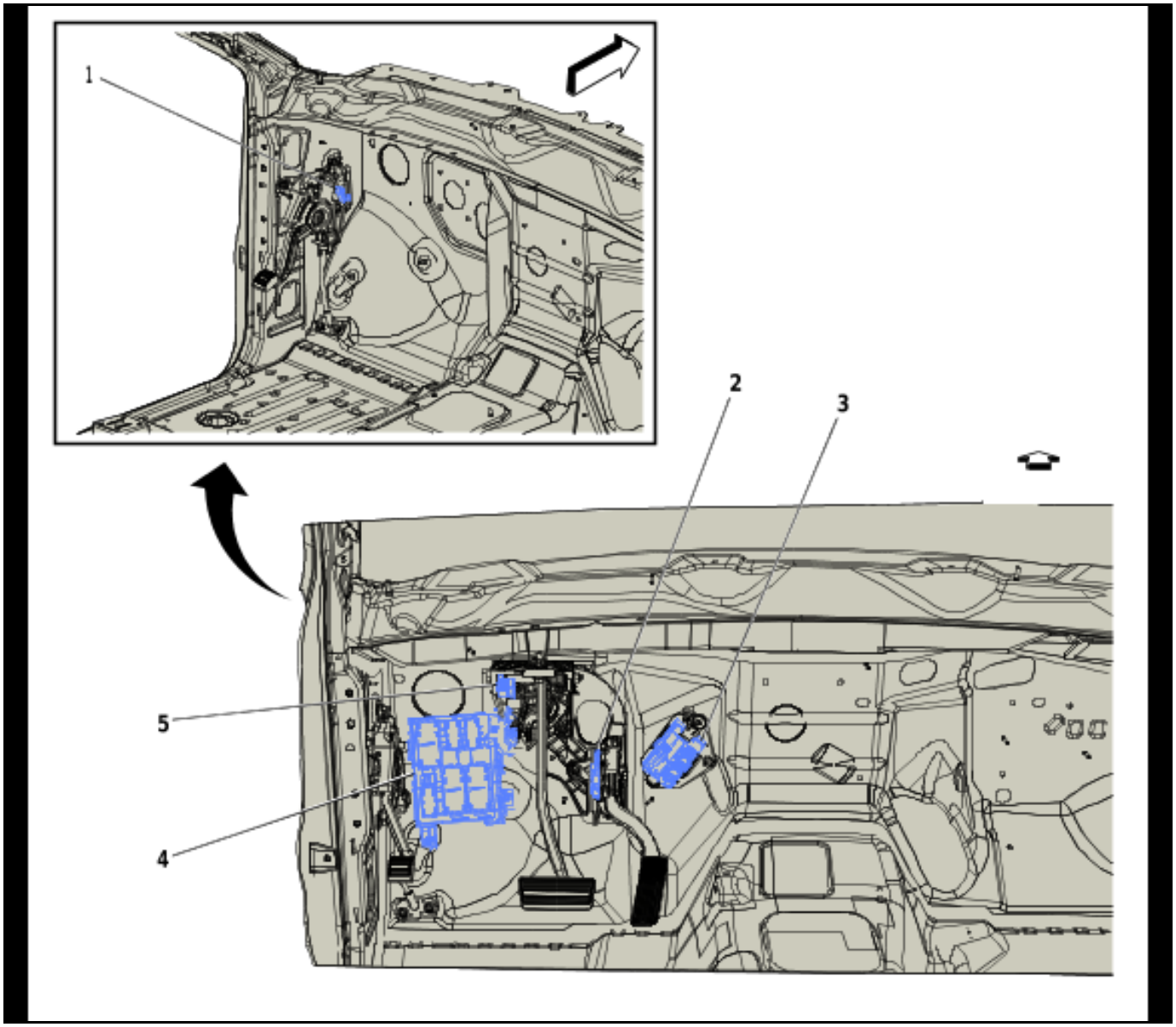
4975681

Items

(1) B14B Transmission Turbine Speed Sensor
(2) B14A Transmission Output Shaft Speed Sensor
(3) B115 Vehicle Speed Sensor (NQF)
(4) A16 Transfer Case Motor (NQF)

Instrument Panel/Center Console Component Views

Bulkhead Components - Interior

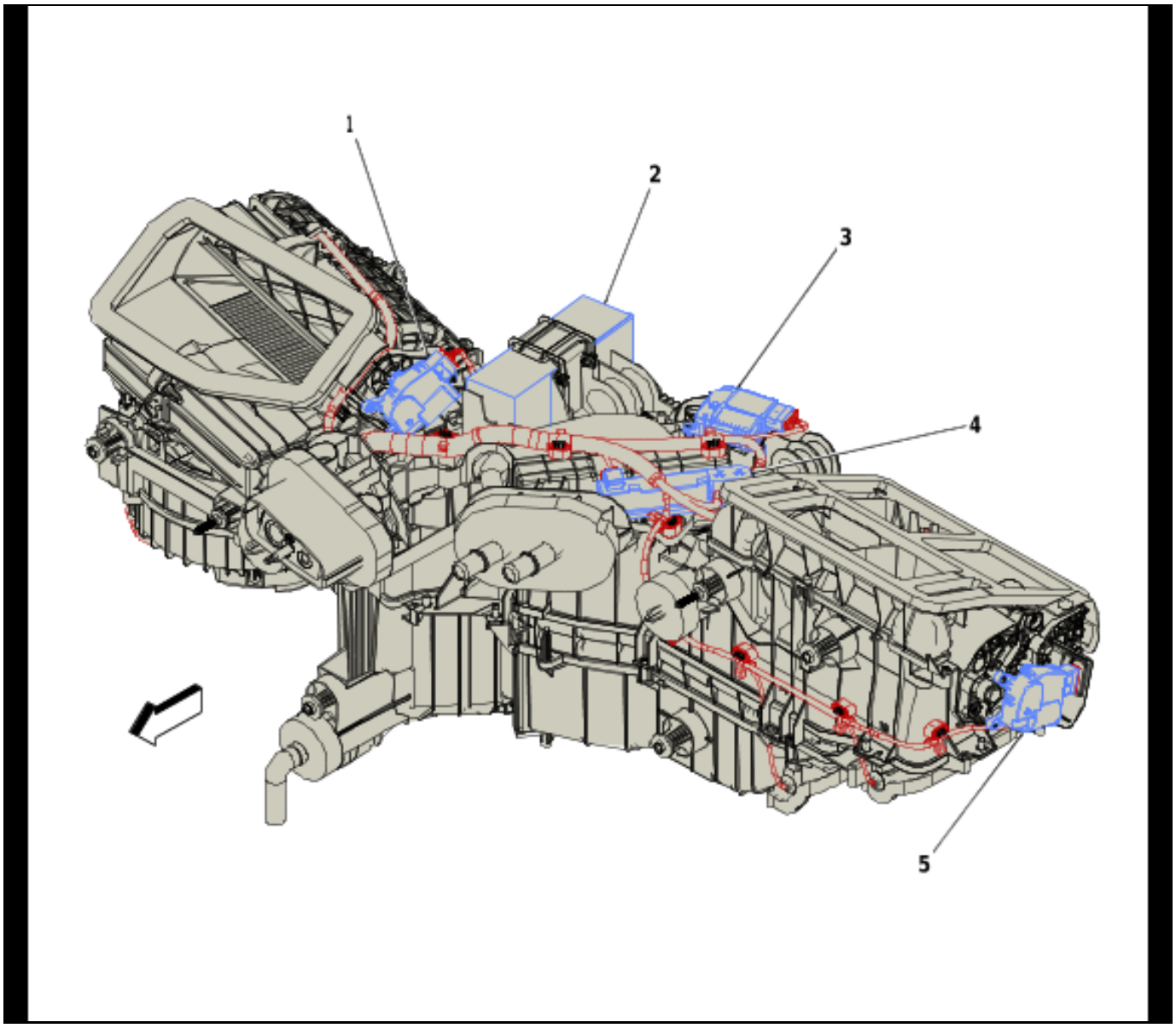


4975682

Items

(1) B80 Park Brake Switch
(2) B107 Accelerator Pedal Position Sensor
(3) K69 Transfer Case Control Module (NQF)
(4) X61A Junction Block - Instrument Panel
(5) B22 Brake Pedal Position Sensor

Front of HVAC Assembly Components

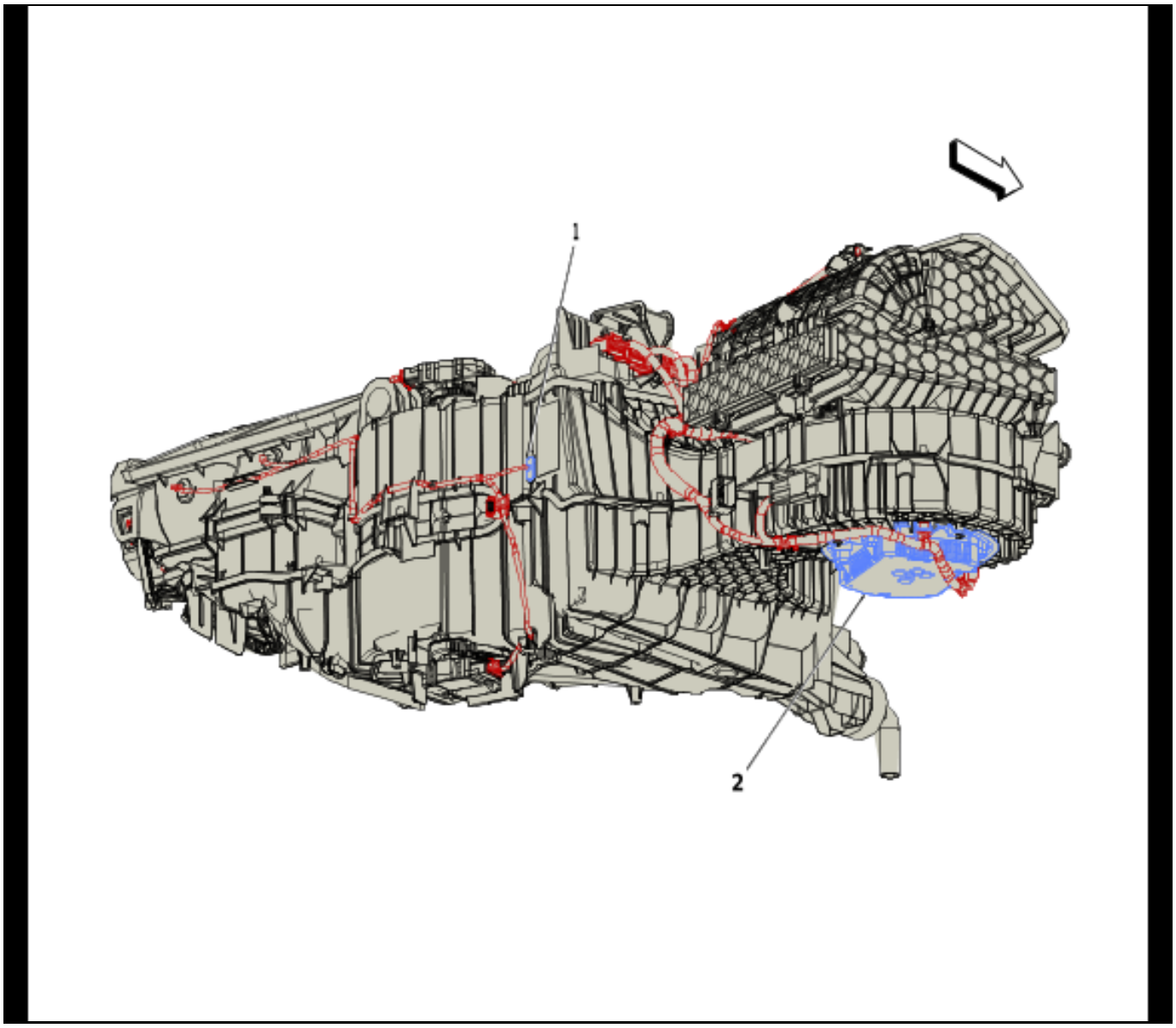


4975558

Items

(1) M4 Air Inlet Door Actuator
(2) K33 HVAC Control Module
(3) M6 Air Temperature Door Actuator
(4) E40 Electrical Auxiliary Heater (C32)
(5) M37 Mode Door Actuator

Back of HVAC Assembly Components

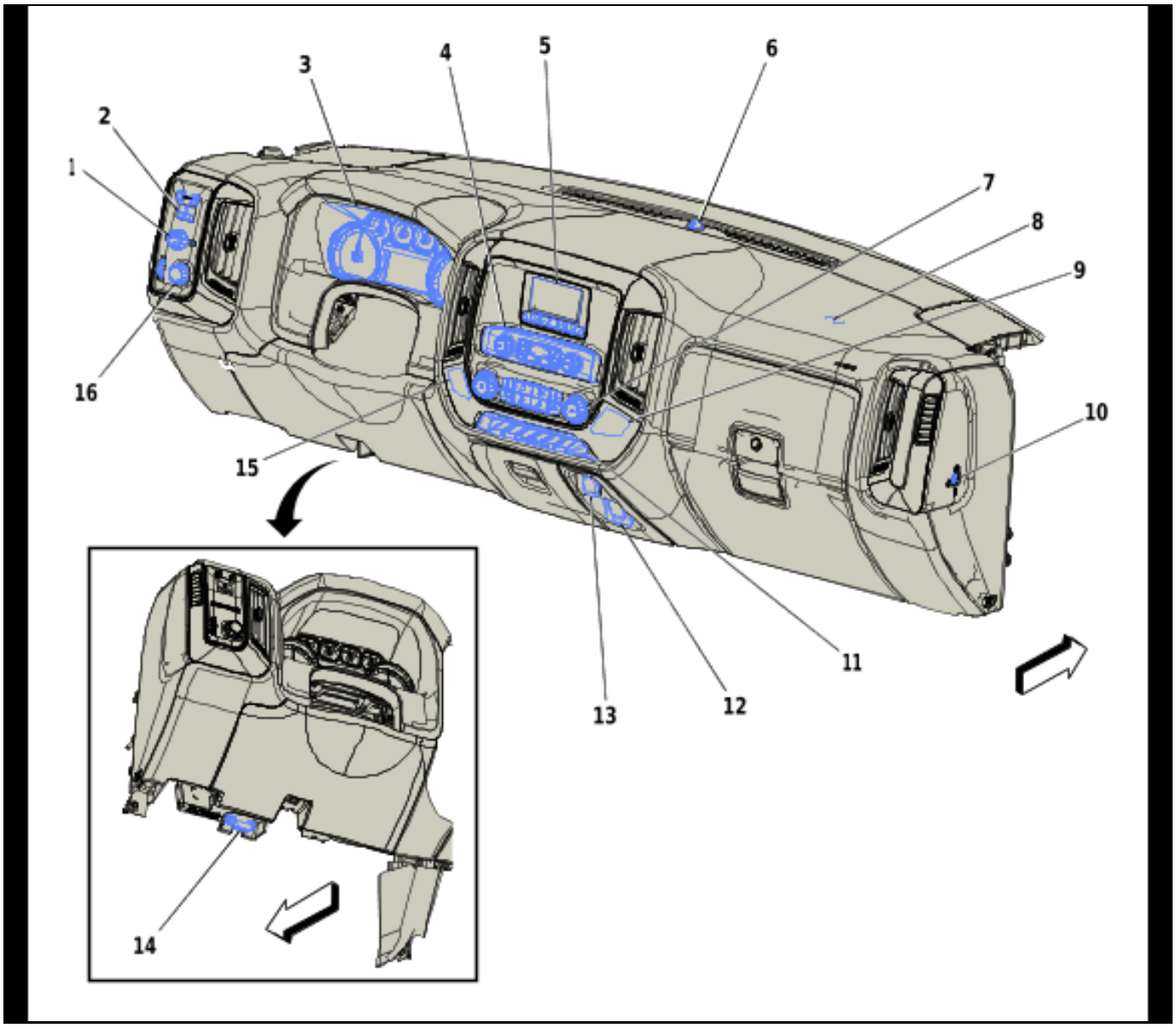


4975563

Items

(1) B39 A/C Evaporator Temperature Sensor
(2) M8 Blower Motor

Face of Instrument Panel Components

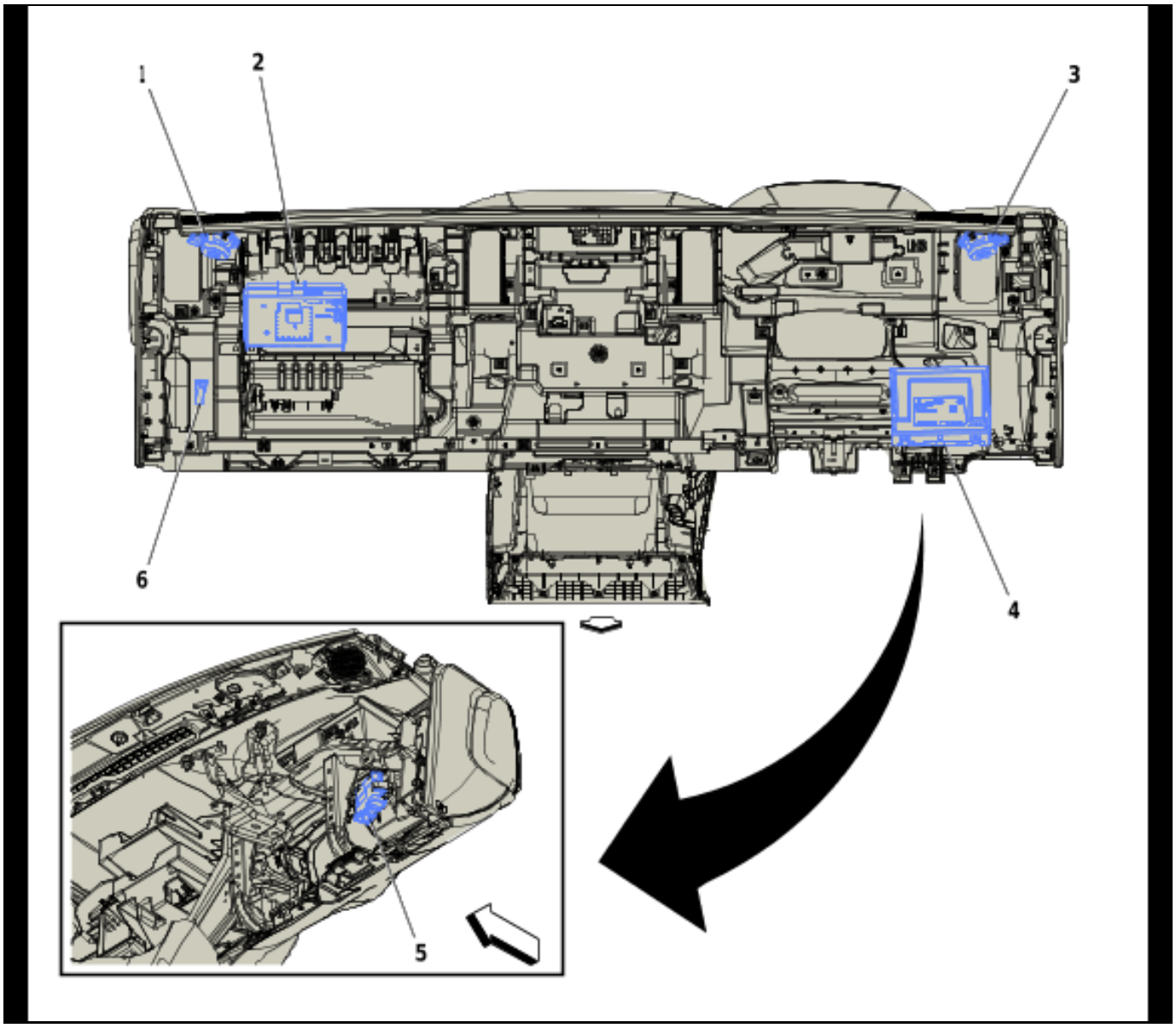


4975567

Items

(1) S77 Transfer Case Shift Control Switch (NQF)
(2) S76 Trailer Brake Control Switch (JL1)
(3) P16 Instrument Cluster
(4) A22 Radio Controls
(5) P17 Info Display Module
(6) B10B Ambient Light/Sunload Sensor
(7) A26 HVAC Controls
(8) F101 Passenger Instrument Panel Air Bag (AJ7/AY0)
(9) S32P Seat Heating Switch - Passenger (KA1)
(10) S40 Passenger Air Bag Disable Switch (C99)
(11) S48A Multifunction Switch - Instrument Panel
(12) X81 Accessory Power Receptacle - 110V AC (KI4)
(13) X80G Accessory Power Receptacle - Instrument Panel (-D07)
(14) X84 Data Link Connector
(15) S32D Seat Heating Switch - Driver (KA1)
(16) S30 Headlamp Switch

Backside of Instrument Panel Components



5909860

Items

(1) P19W Speaker - Right Instrument Panel (UQ3)

(2) K74 Human Machine Interface Control Module (IO5)

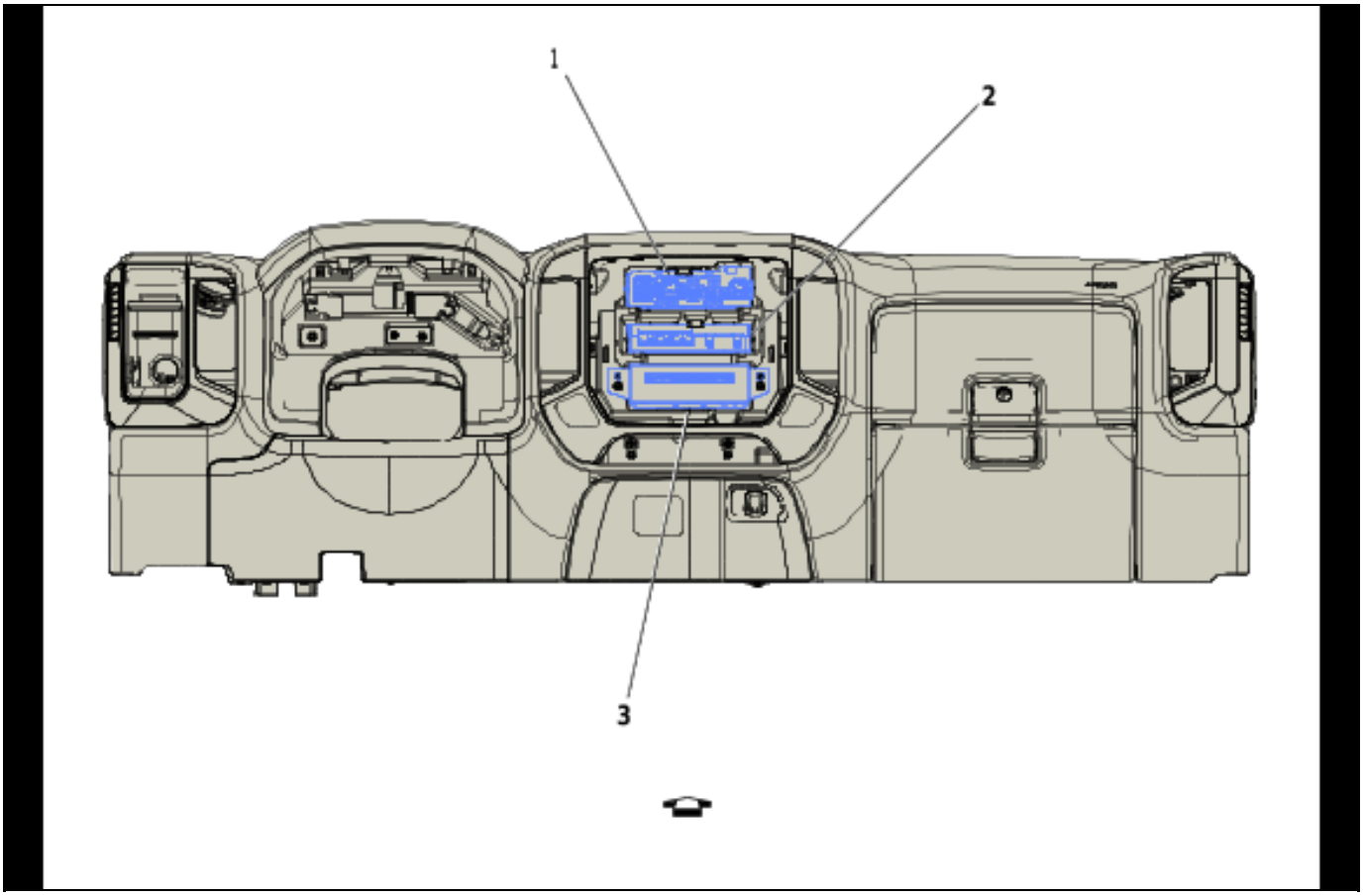
(3) P19J Speaker - Left Instrument Panel (UQ3)

(4) K9 Body Control Module

(5) K56 Serial Data Gateway Module

(6) R6F Terminating Resistor - High Speed Extension Bus 2 (IO5/UE1)

Inside Center of Instrument Panel Components



4975571

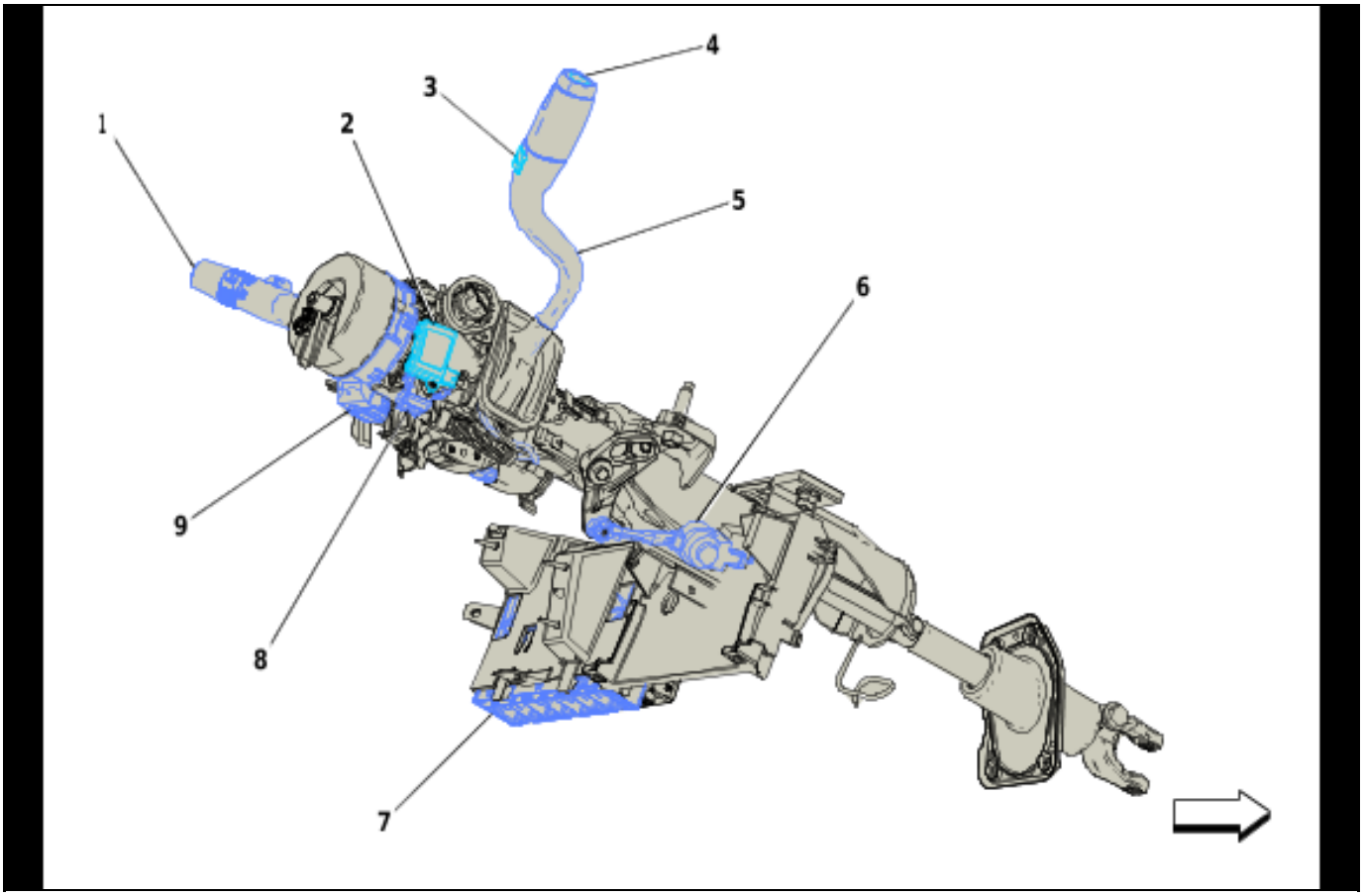
Items

(1) A11 Radio

(2) K73 Telematics Communication Interface Control Module (UE1)

(3) A33 Media Disc Player (TG5)

Steering Column Components

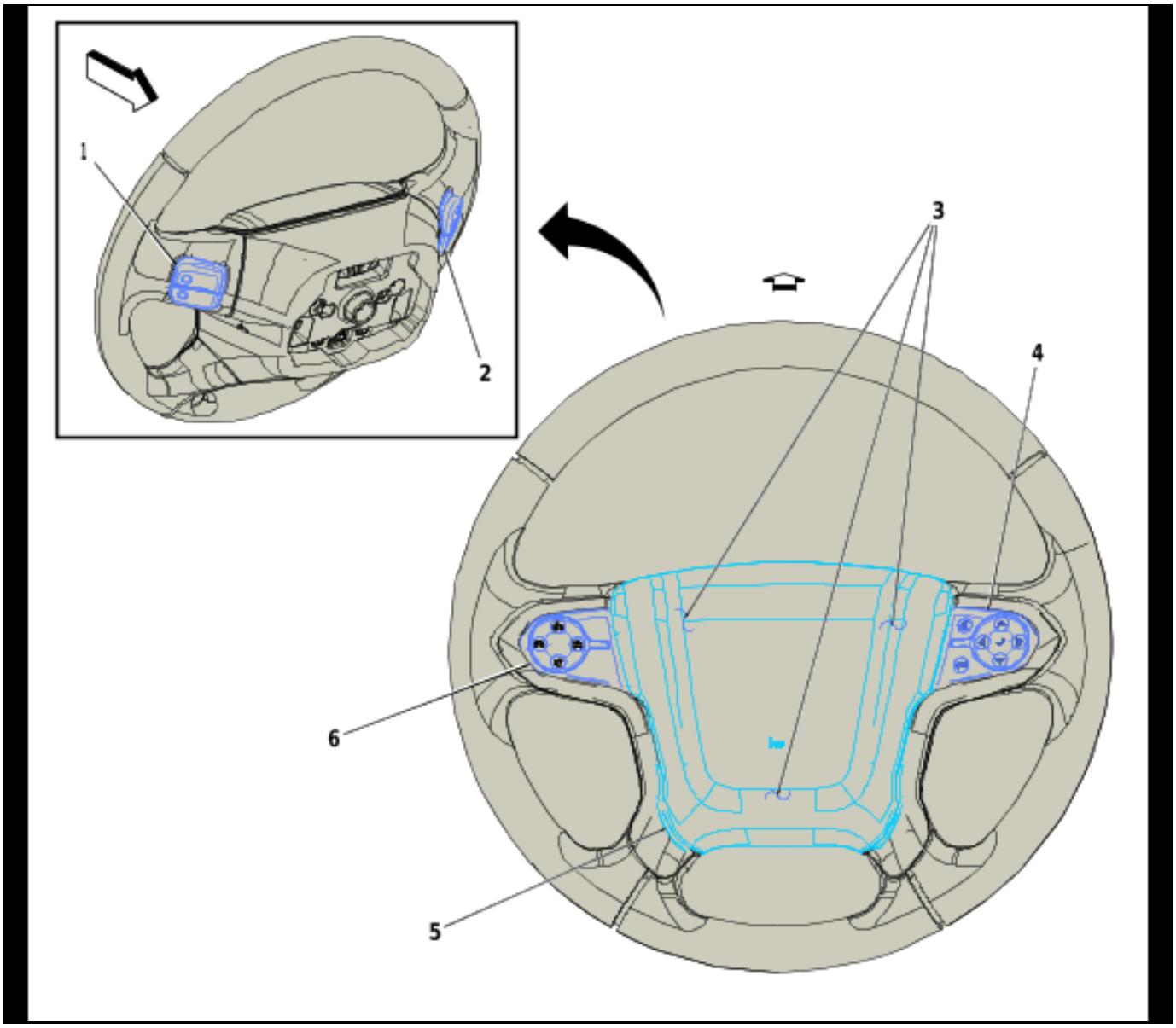


5132062

Items

(1) S78 Turn Signal/Multifunction Switch
(2) K89 Immobilizer Control Module
(3) S2 Transmission Manual Shift Switch
(4) S74 Tow/Haul Mode Switch
(5) S3 Transmission Shift Lever
(6) M7 Transmission Shift Lock Control Solenoid Actuator
(7) K9 Body Control Module
(8) S39 Ignition Switch
(9) X85 Steering Wheel Air Bag Coil

Steering Wheel Components



5169846

Items

(1) S70F Steering Wheel Controls Switch - Radio Volume (UK3)

(2) S70E Steering Wheel Controls Switch - Radio Presets (UK3)

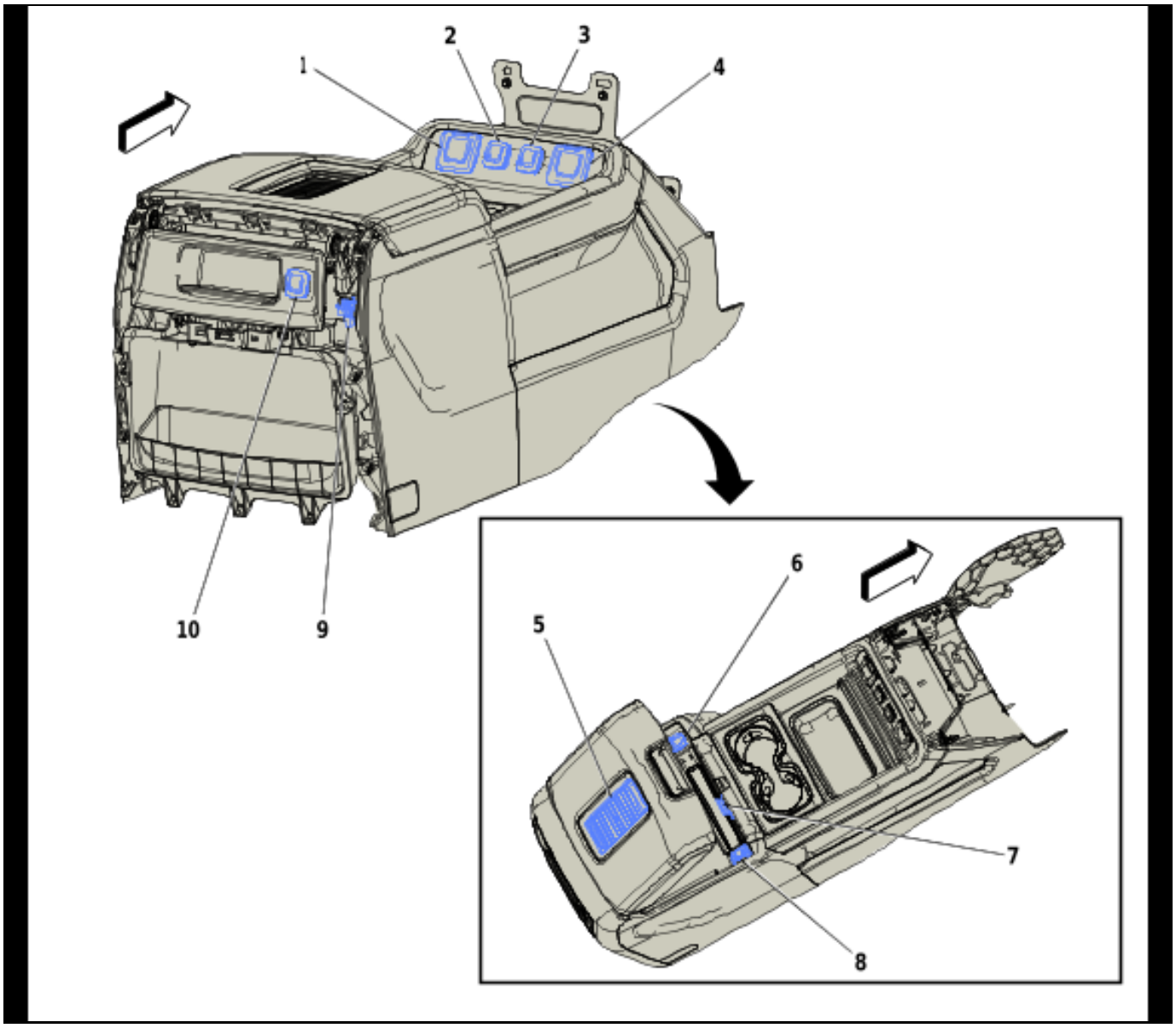
(3) S33 Horn Switch

(4) S70R Steering Wheel Controls Switch - Right (UK3)

(5) F107 Steering Wheel Air Bag

(6) S70L Steering Wheel Controls Switch - Left

Floor Console Components (D07)



4975573

Items

(1) X92 USB Receptacle (IO5)

(2) X80J Accessory Power Receptacle - Instrument Panel 1 (D07)

(3) X80K Accessory Power Receptacle - Instrument Panel 2 (D07)

(4) X81 Accessory Power Receptacle - 110V AC (KI4)

(5) T22 Mobile Device Wireless Charger Module (K4C)

(6) X80D Accessory Power Receptacle - Center Console Compartment

(7) E28 Center Console Compartment Lamp (D07)

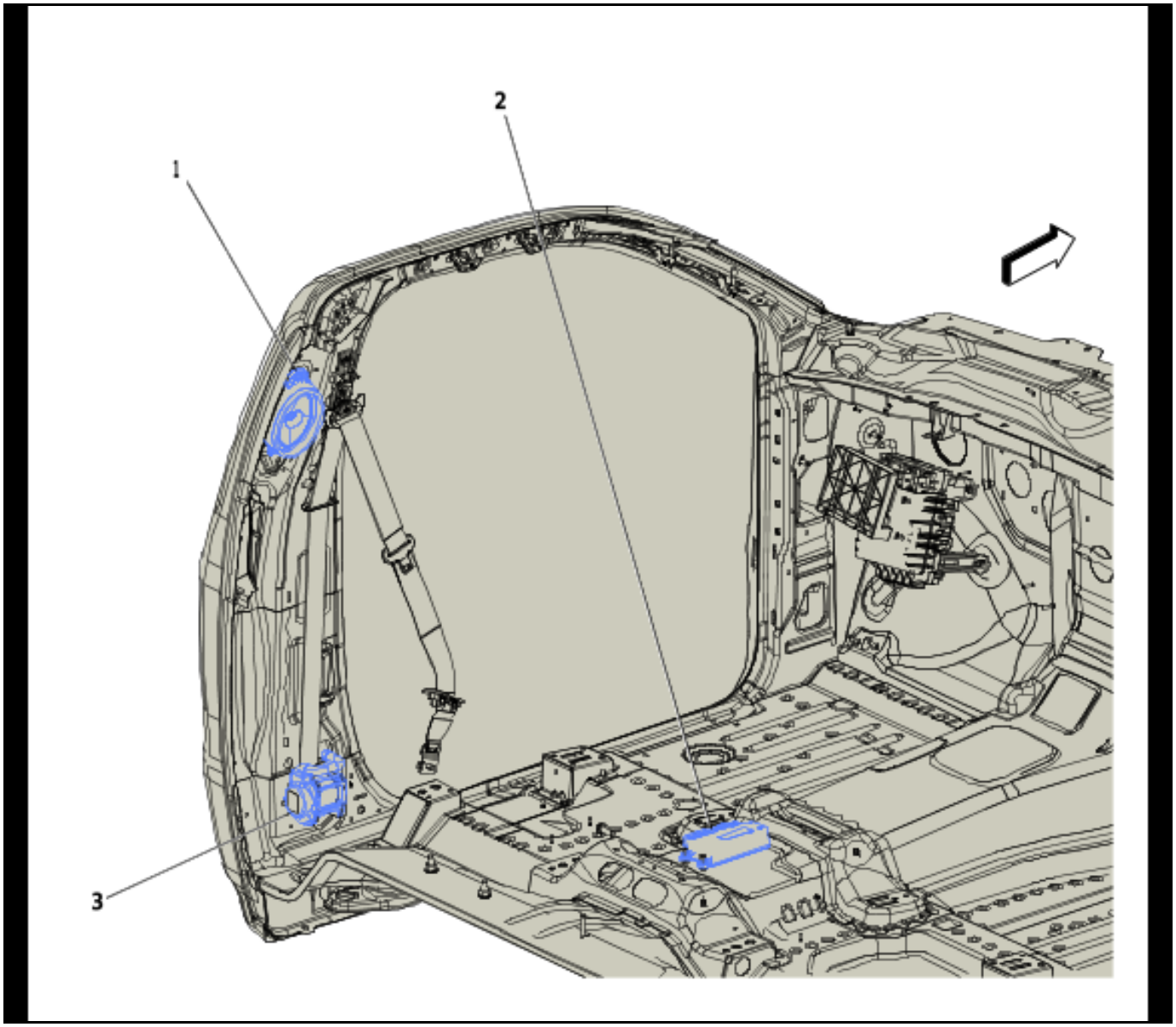
(8) X83 Auxiliary Audio Input

(9) S5 Center Console Compartment Lamp Switch (D07)

(10) X80L Accessory Power Receptacle - Center Console Rear (D07)

Passenger Compartment/Roof Component Views

Passenger Compartment Components - Left



4992543

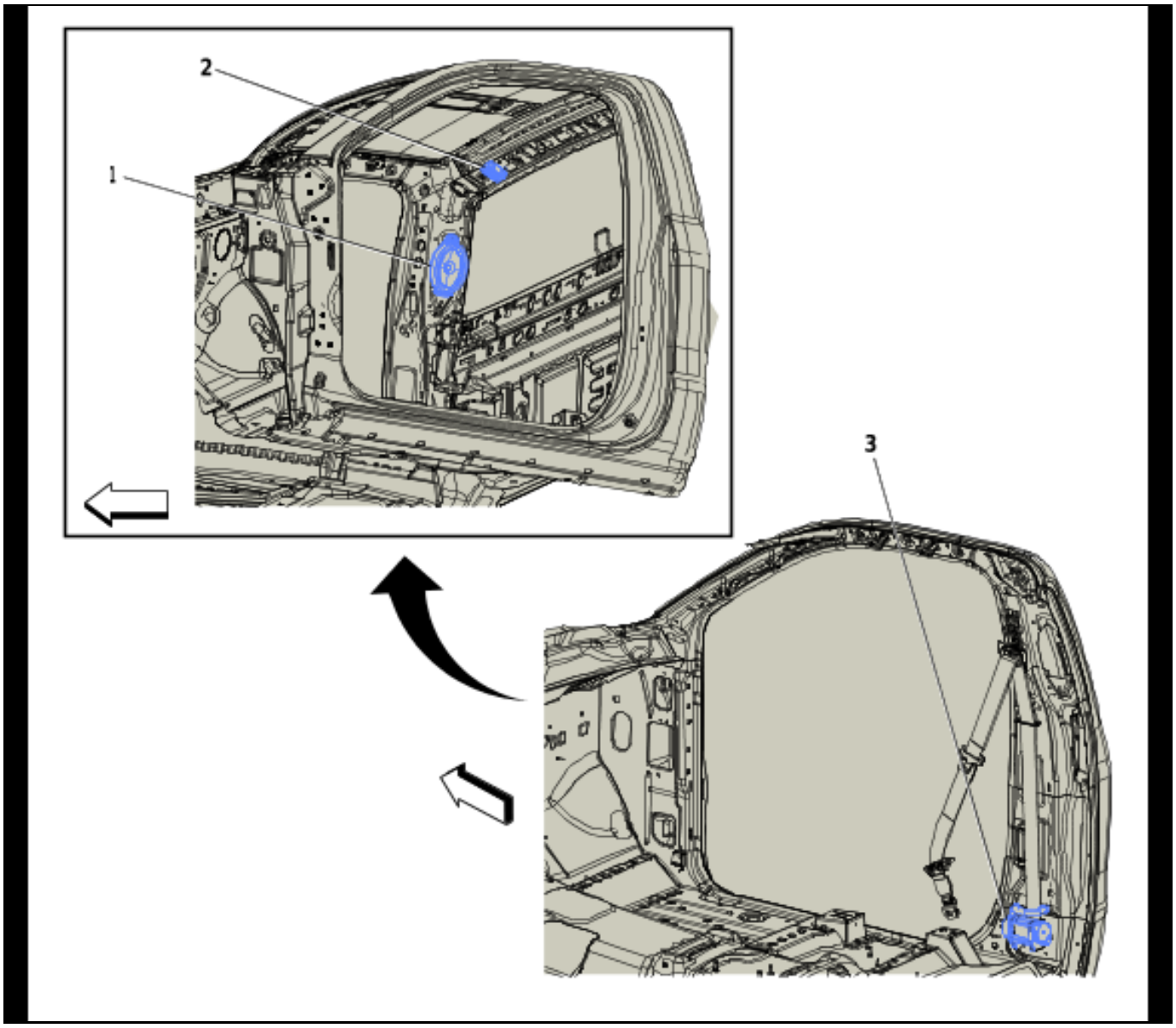
Items

(1) P19AN Speaker - Left Rear Trim Panel (Standard Cab)

(2) K36 Inflatable Restraint Sensing and Diagnostic Module

(3) F112D Seat Belt Retractor Pretensioner - Driver

Passenger Compartment Components - Right



4992544

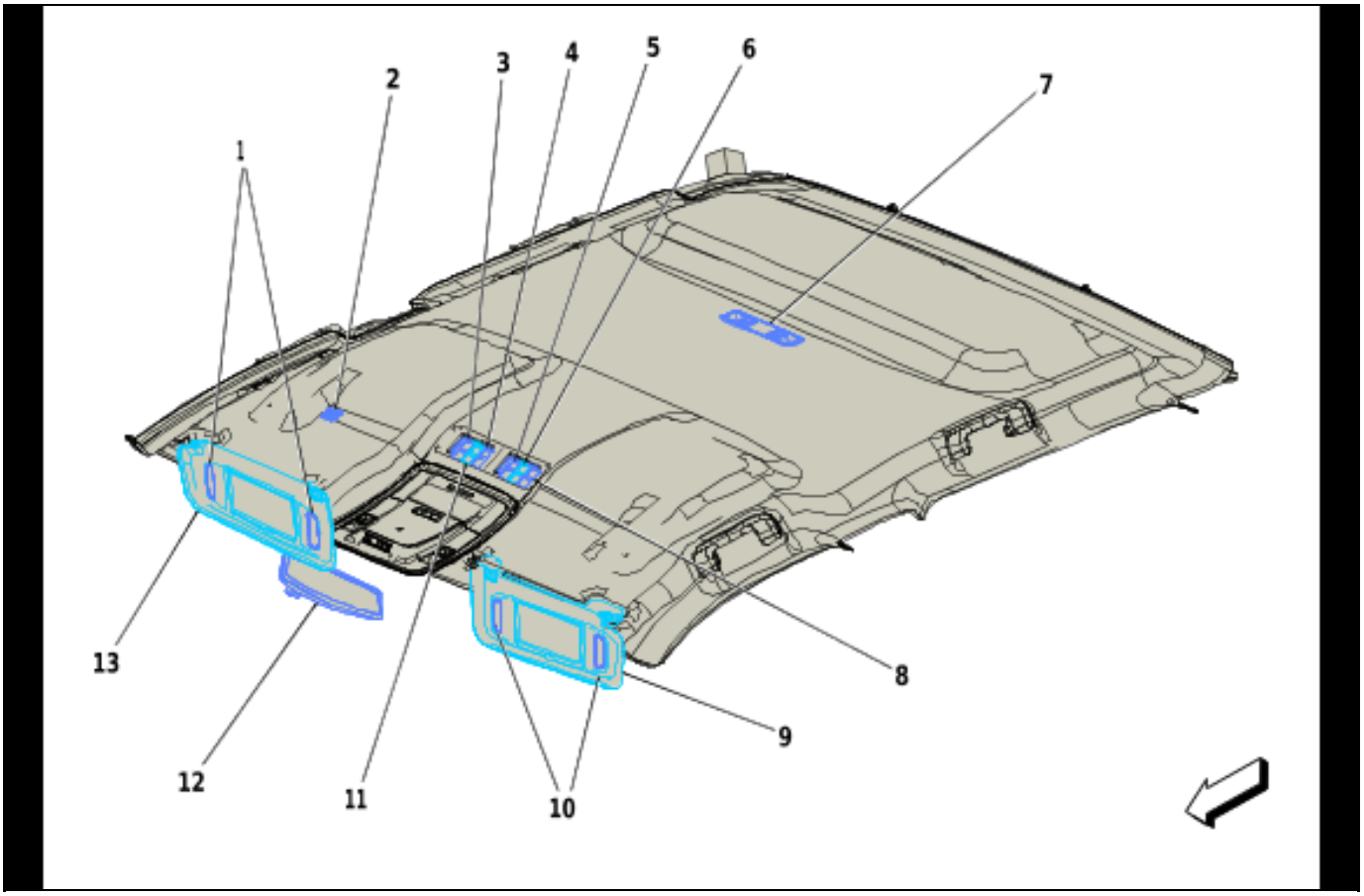
Items

(1) P19AP Speaker - Right Rear Trim Panel (Standard Cab)

(2) K77 Remote Control Door Lock Receiver

(3) F112P Seat Belt Retractor Pretensioner - Passenger

Headliner Components

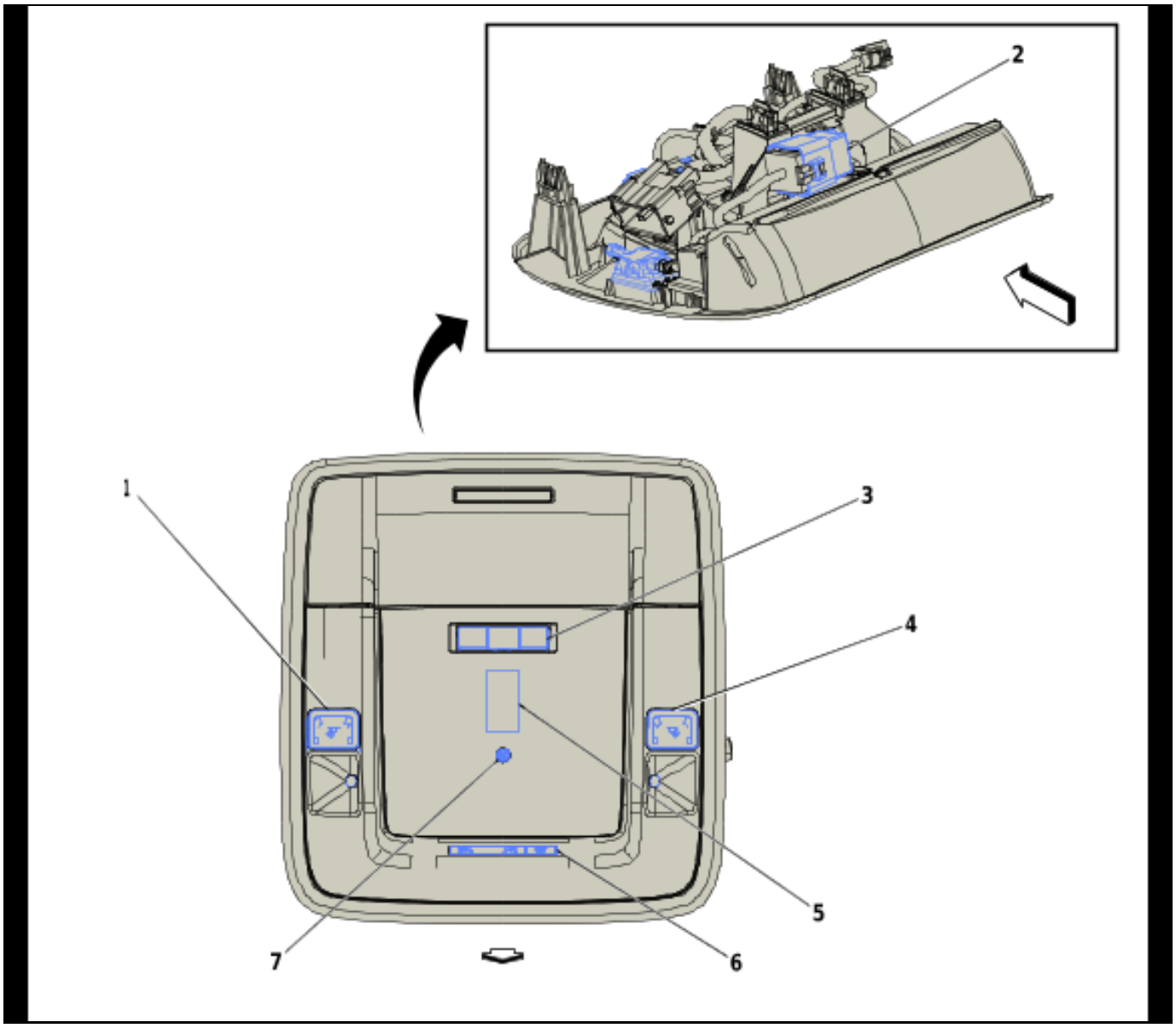


4975683

Items

(1) E31L Sunshade Mirror Lamp - Left (DH6)
(2) B24 Mobile Telephone Microphone
(3) S181E Configurable Provision Switch 5 (UEH)
(4) S181G Configurable Provision Switch 7 (UEH)
(5) S181H Configurable Provision Switch 8 (UEH)
(6) S181J Configurable Provision Switch 9 (UEH)
(7) E37B Dome/Reading Lamps - 2nd Row (Crew Cab)
(8) S181K Configurable Provision Switch 10 (UEH)
(9) A3R Sunshade - Right (DH6)
(10) E31R Sunshade Mirror Lamp - Right (DH6)
(11) S181F Configurable Provision Switch 6 (UEH)
(12) A10 Inside Rearview Mirror (DD8/UE1)
(13) A3L Sunshade - Left (DH6)

Overhead Console Components



5257810

Items

(1) E37EL Dome/Reading Lamps - Front Overhead Console Left

(2) KR58 Roof Beacon Relay

(3) S12 Dome Lamp Switch

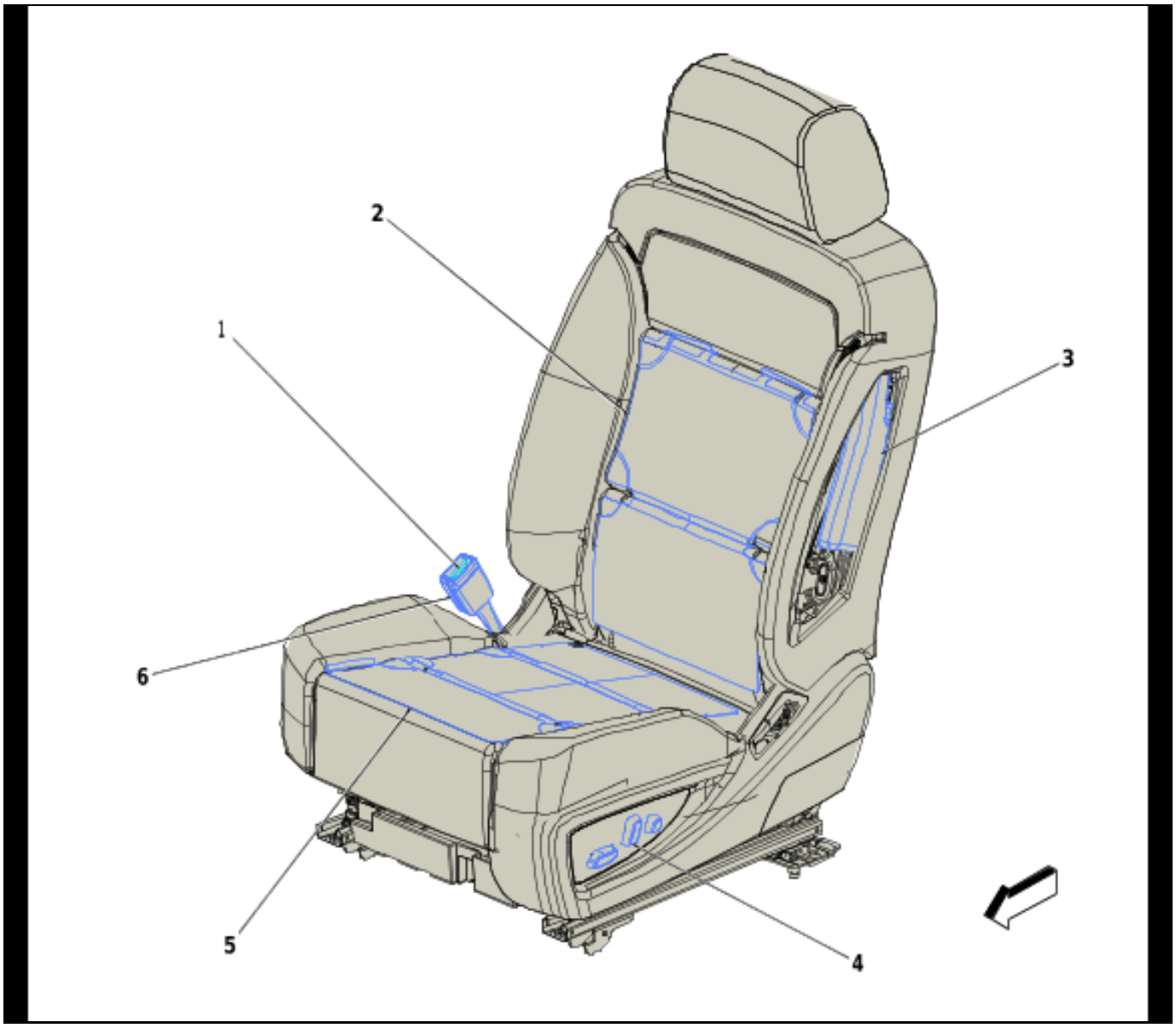
(4) E37ER Dome/Reading Lamps - Front Overhead Console Right

(5) S63 Roof Beacon Switch (TRW)

(6) P14 Passenger Air Bag Disabled Indicator

(7) E1L Accent Lamp - Overhead Console

Front of Driver Seat Components



5323273

Items

(1) B88D Seat Belt Switch - Driver

(2) E14A Seat Heating Element - Driver Back (KA1)

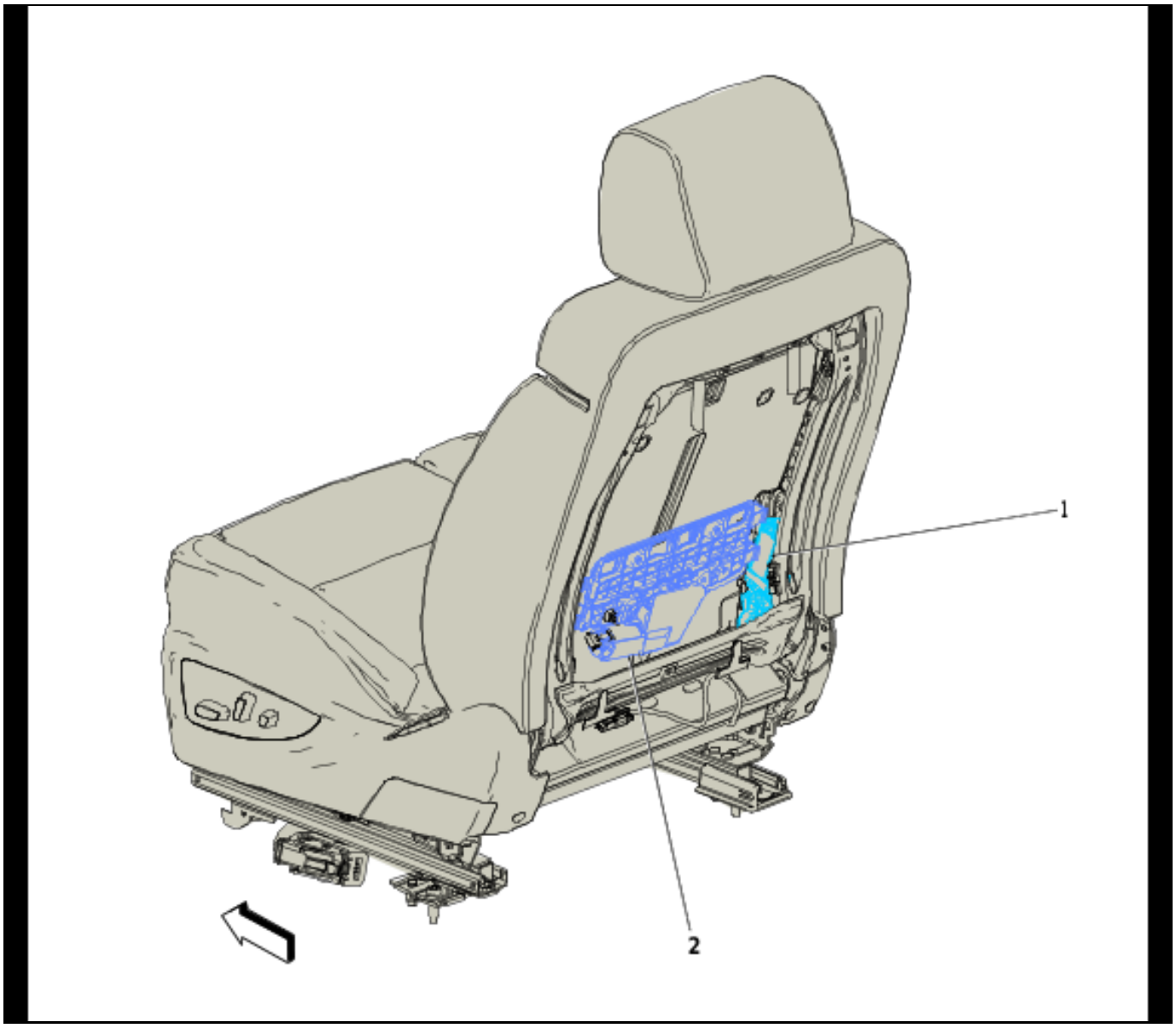
(3) F106D Seat Side Air Bag - Driver

(4) S64D Seat Adjuster Switch - Driver (A95/AG1)

(5) E14B Seat Heating Element - Driver Cushion (KA1)

(6) B153D Seat Belt Buckle - Driver

Back of Driver Seat Components (A95/AG1)



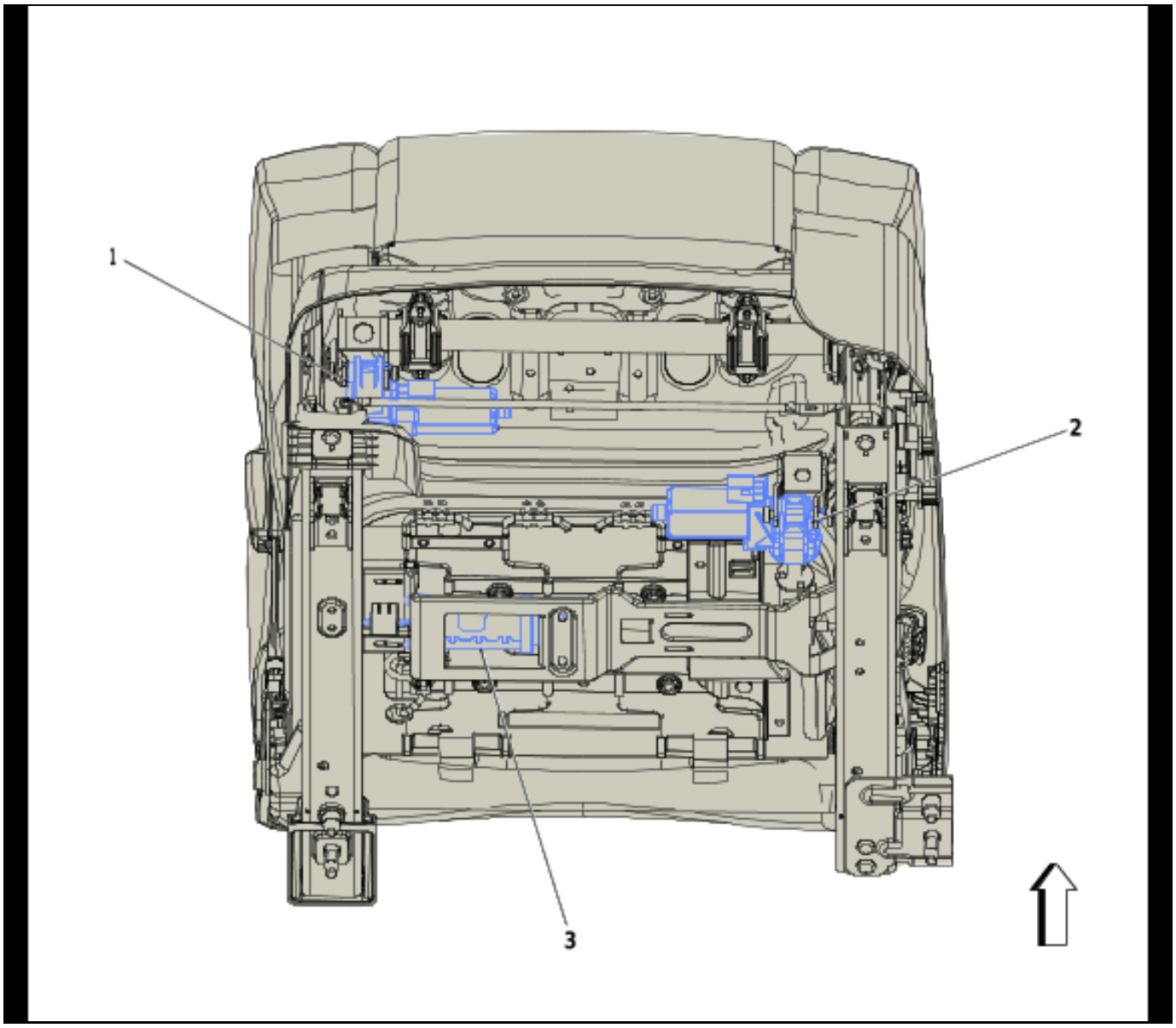
4975687

Items

(1) M56D Seat Recline Motor - Driver (A95/AG1)

(2) M52D Seat Lumbar Support Horizontal Motor - Driver (A95)

Bottom of Driver Seat Components (A95/AG1)



4975690

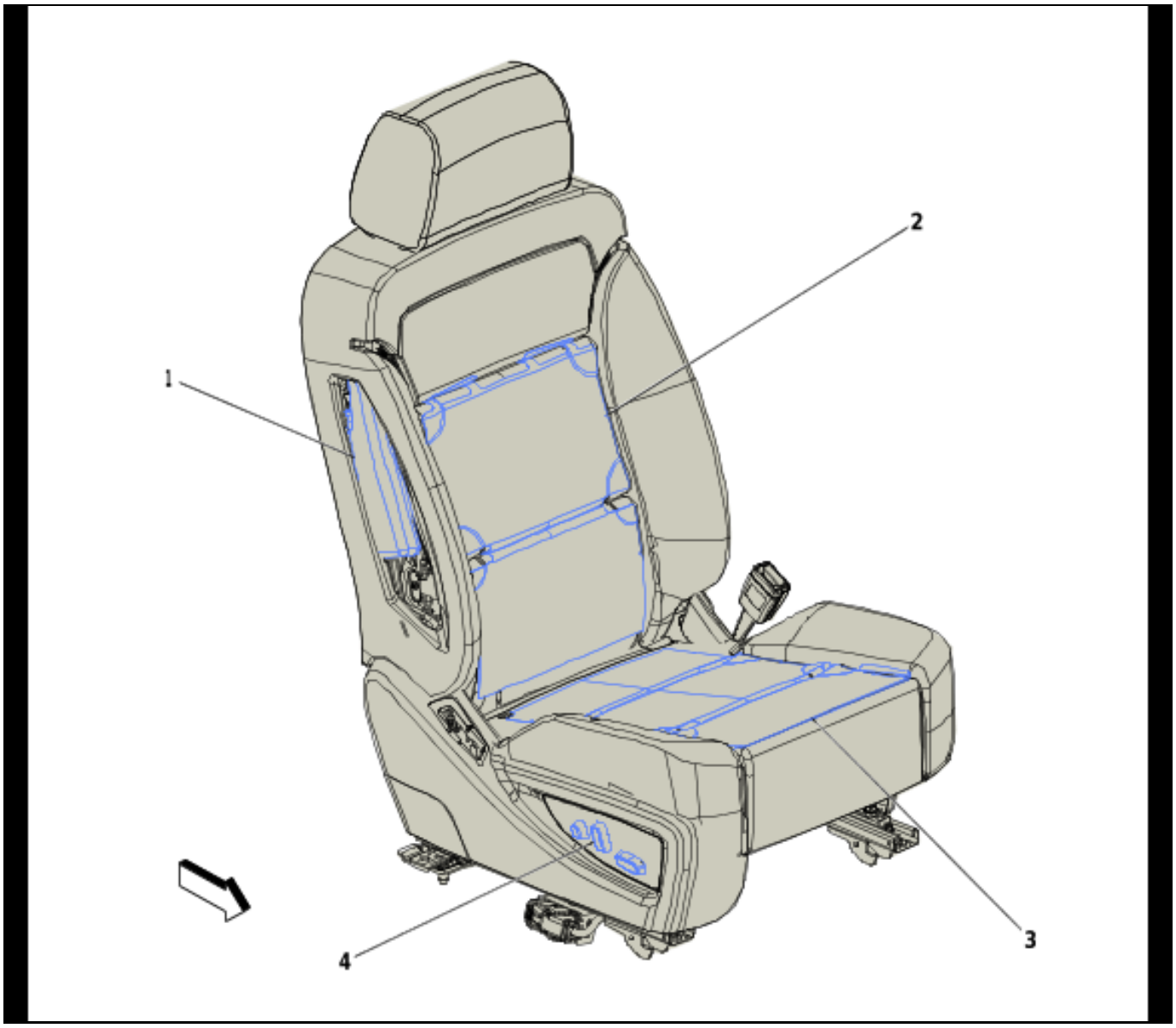
Items

(1) M50D Seat Front Vertical Motor - Driver (A95/AG1)

(2) M55D Seat Rear Vertical Motor - Driver (A95/AG1)

(3) M51D Seat Horizontal Motor - Driver (A95/AG1)

Front of Passenger Seat Components



5323276

Items

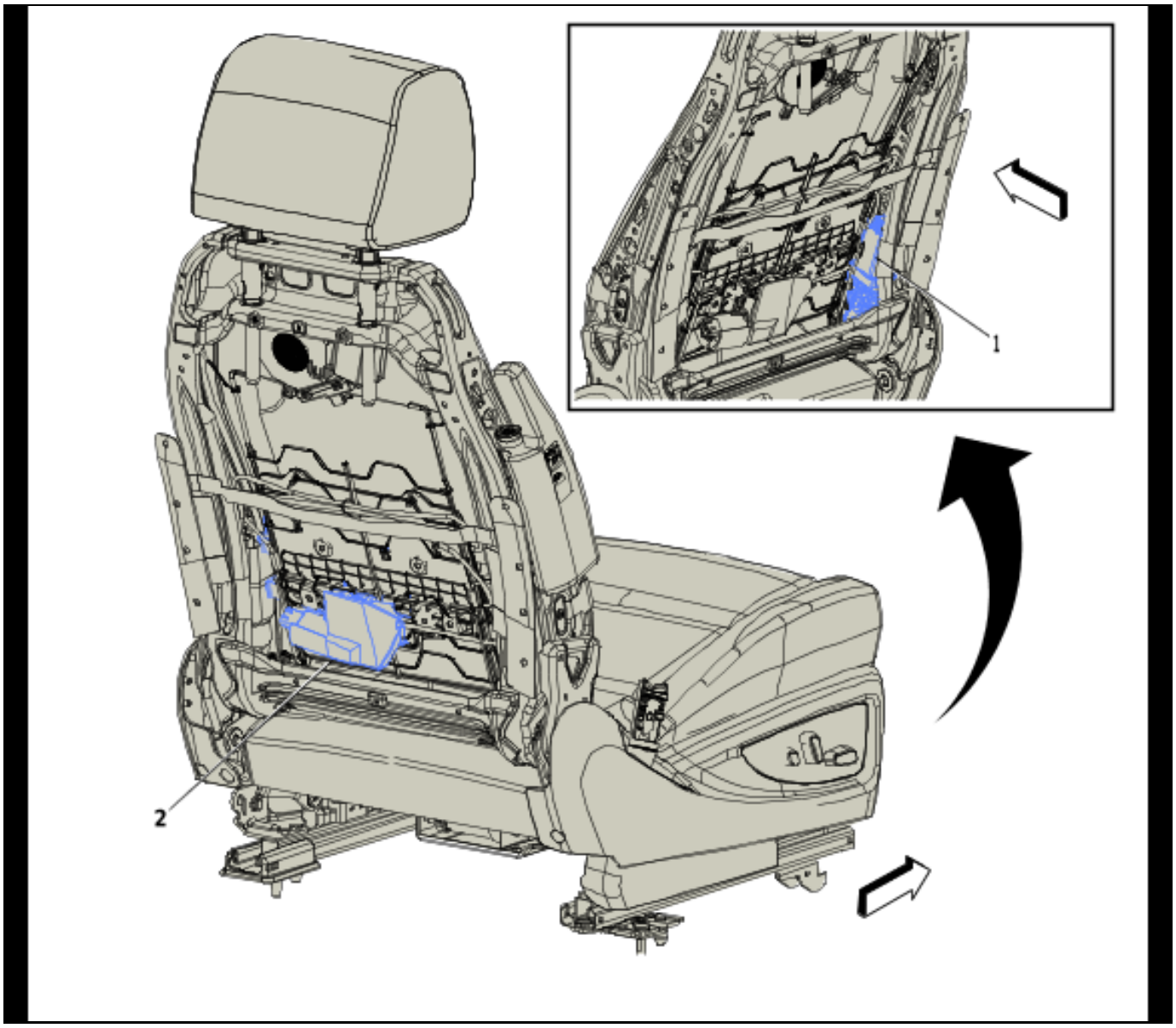
(1) F106P Seat Side Air Bag - Passenger (AJ7/ AY0)

(2) E14C Seat Heating Element - Passenger Back (KA1)

(3) E14D Seat Heating Element - Passenger Cushion (KA1)

(4) S64P Seat Adjuster Switch - Passenger (A95)

Back of Passenger Seat Components (A95)



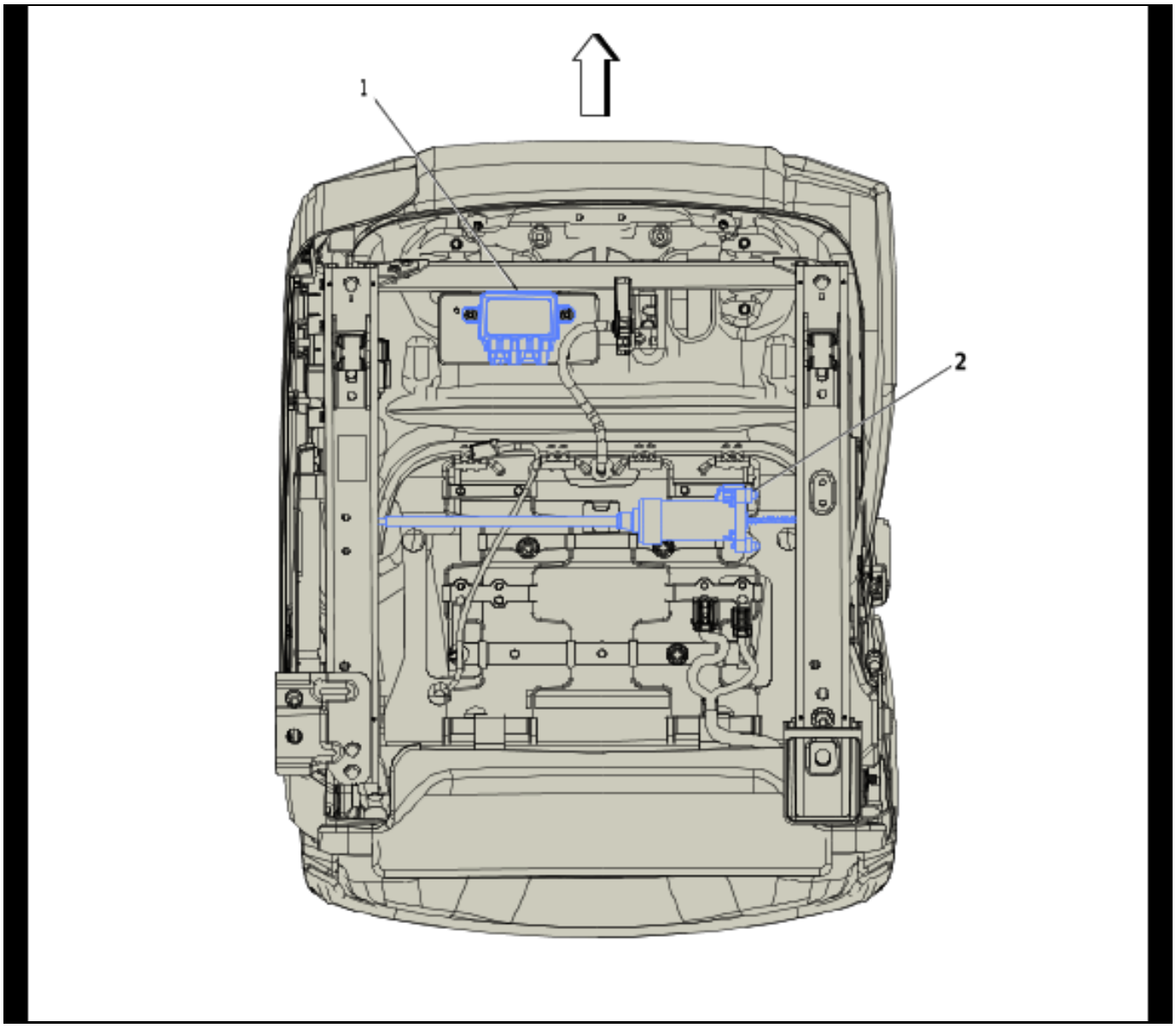
5326342

Items

(1) M56P Seat Recline Motor - Passenger (A95)

(2) M52P Seat Lumbar Support Horizontal Motor - Passenger (A95)

Bottom of Passenger Seat Components (A95/KA1)



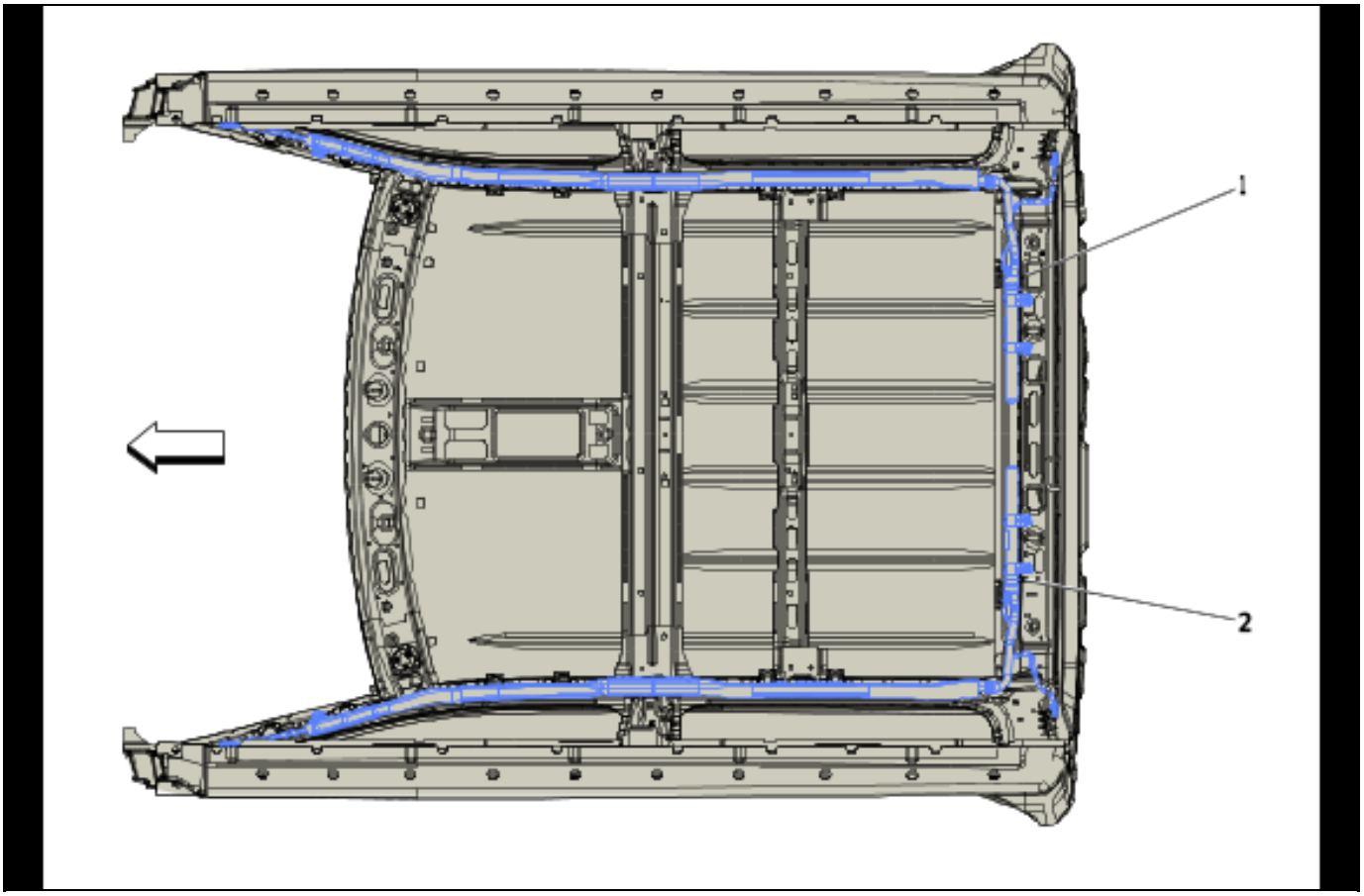
4975697

Items

(1) K29 Seat Heating Control Module (KA1)

(2) M51P Seat Horizontal Motor - Passenger (A95)

Roof Rail Air Bags



5323291

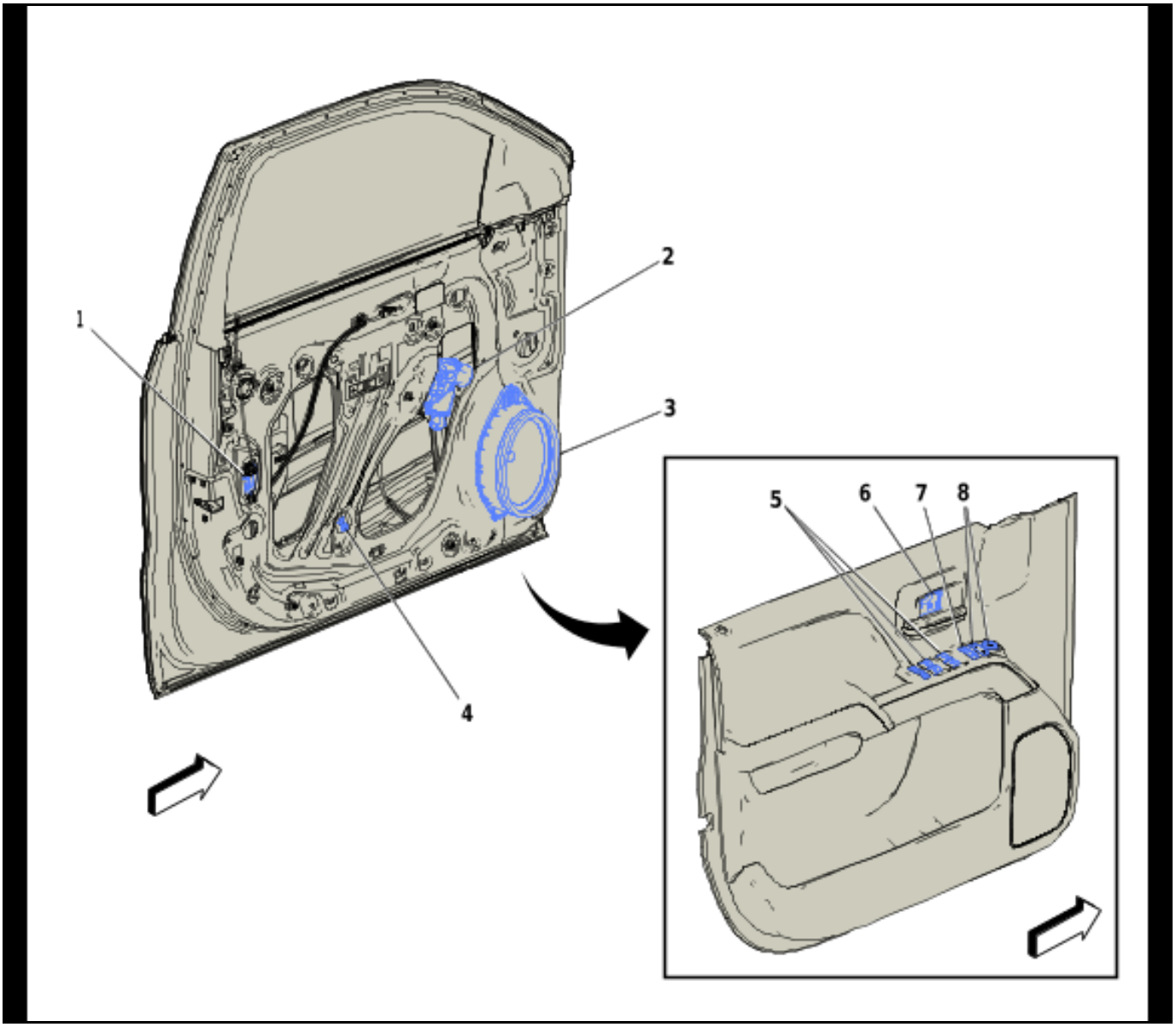
Items

(1) F105L Roof Rail Air Bag - Left (AY0/AY1)

(2) F105R Roof Rail Air Bag - Right (AY0/AY1)

Door Component Views

Driver Door Components

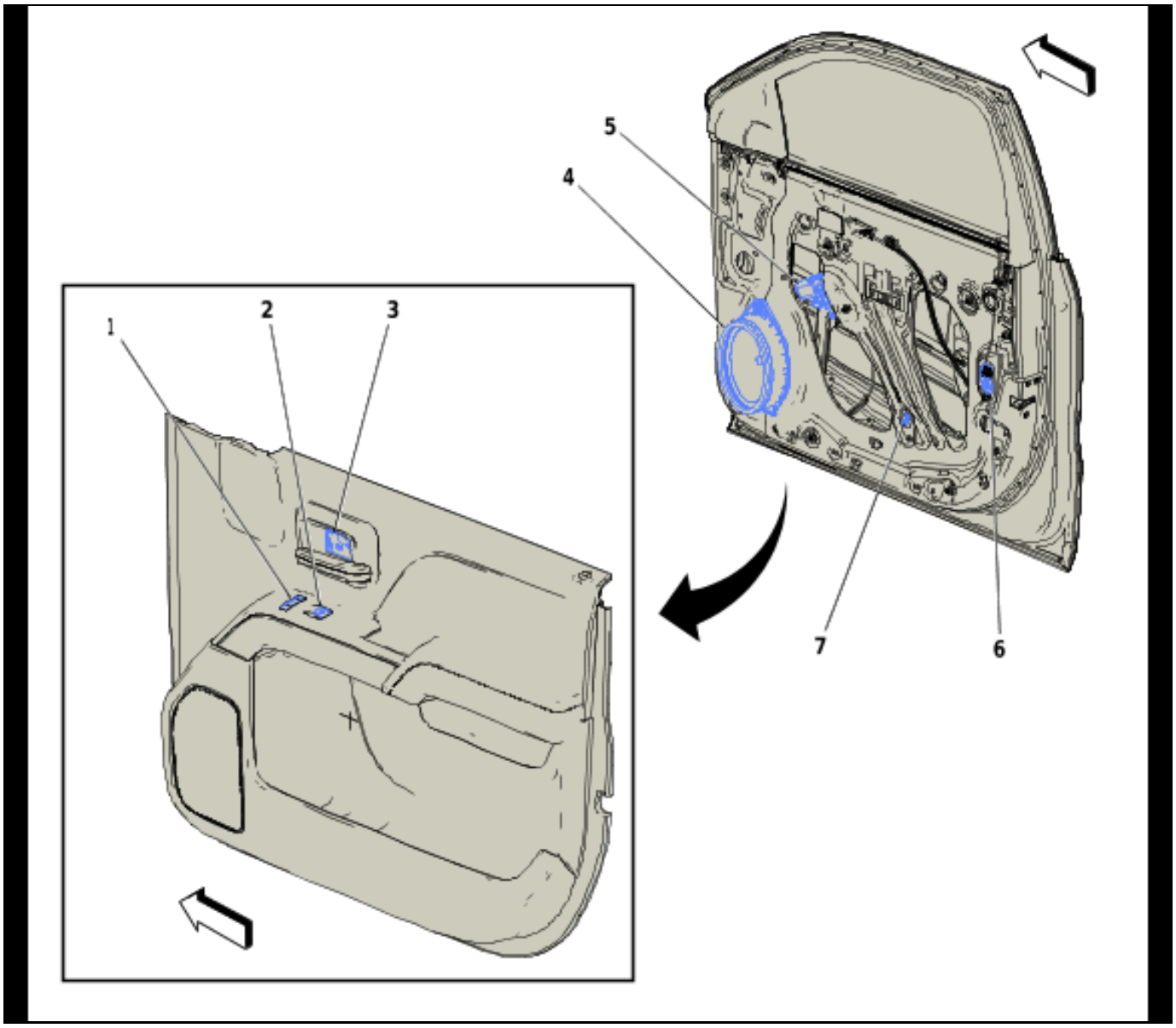


5323280

Items

(1) A23D Door Latch Assembly - Driver
(2) M74D Window Motor - Driver
(3) P19AG Speaker - Left Front Door
(4) B63LF Side Impact Sensor - Left Front
(5) S79D Window Switch - Driver (A31)
(6) E63D Flood Lamp - Driver Door Handle (A31)
(7) S13D Door Lock Switch - Driver
(8) S52 Outside Rearview Mirror Switch (DPN)

Passenger Door Components

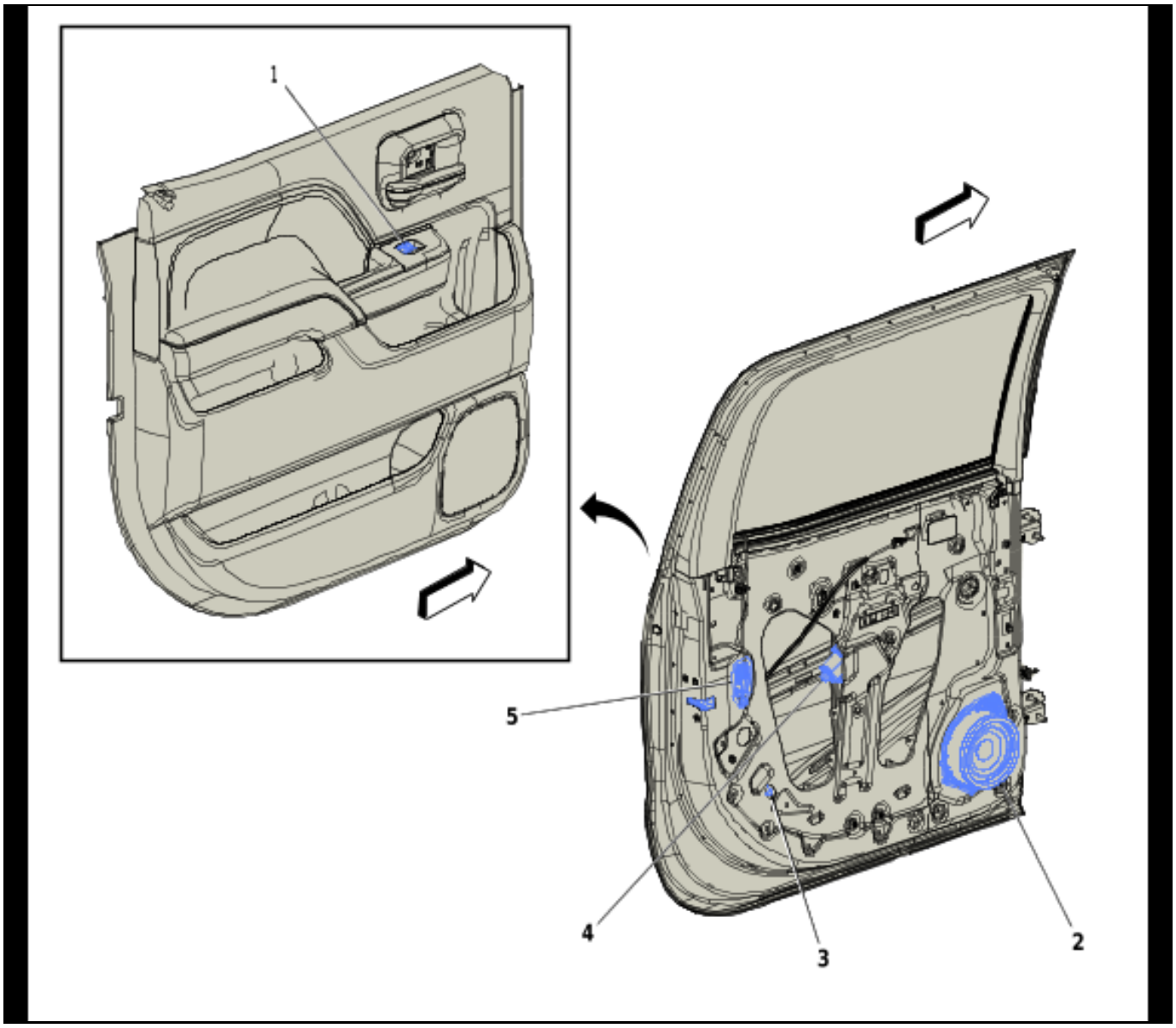


5323282

Items

(1) S13P Door Lock Switch - Passenger
(2) S79P Window Switch - Passenger (A31)
(3) E63P Flood Lamp - Passenger Door Handle (A31)
(4) P19AH Speaker - Right Front Door
(5) M74P Window Motor - Passenger
(6) A23P Door Latch Assembly - Passenger
(7) B63RF Side Impact Sensor - Right Front (AJ7/AY0)

Left Rear Door Components (Crew Cab)



5323284

Items

(1) S79LR Window Switch - Left Rear (Crew Cab)

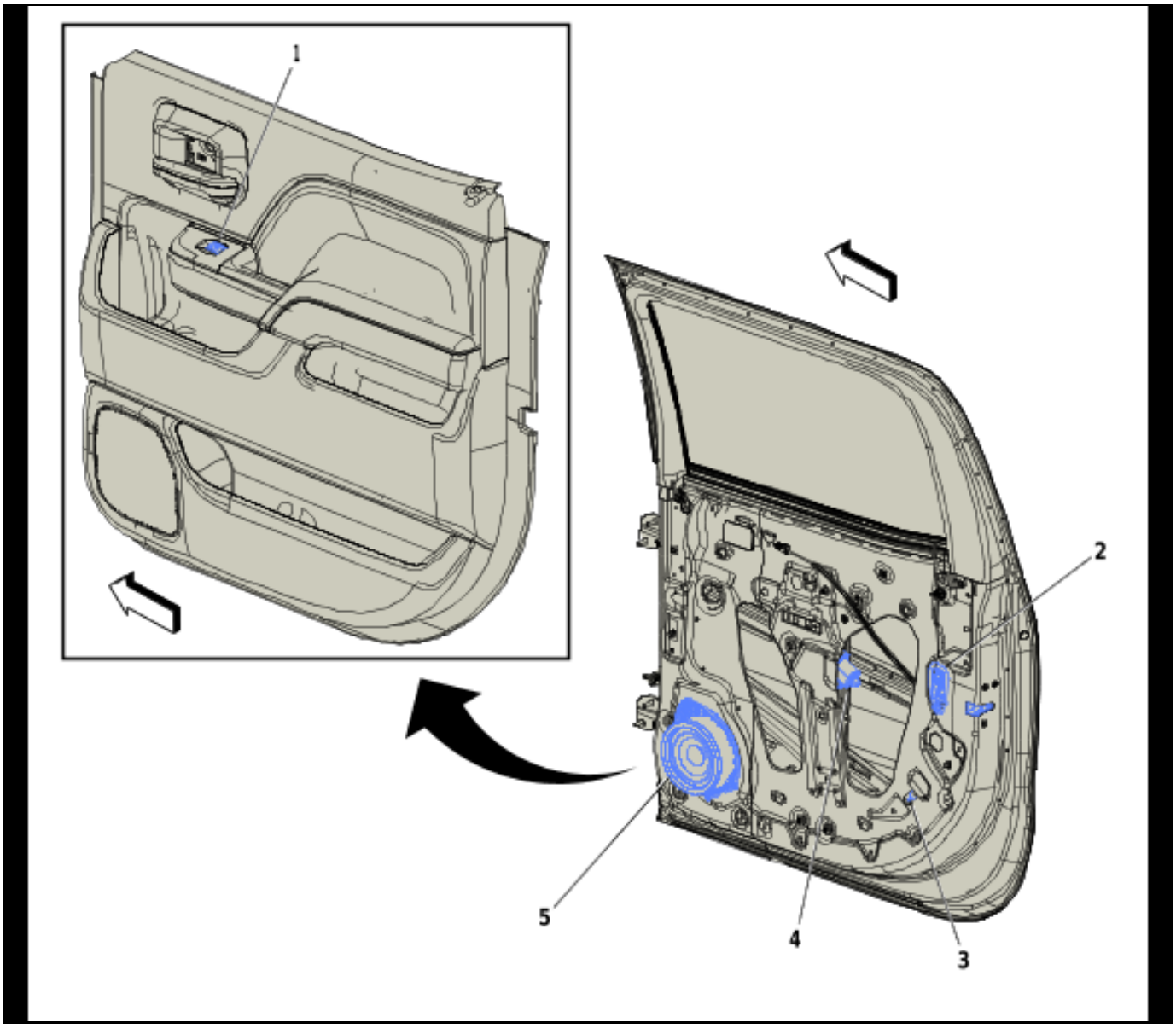
(2) P19AL Speaker - Left Rear Door (Crew Cab)

(3) B63LR Side Impact Sensor - Left Rear (Crew Cab)

(4) M74LR Window Motor - Left Rear (Crew Cab)

(5) A23LR Door Latch Assembly - Left Rear (Crew Cab)

Right Rear Door Components (Crew Cab)



5323286

Items

(1) S79RR Window Switch - Right Rear (Crew Cab)

(2) A23RR Door Latch Assembly - Right Rear (Crew Cab)

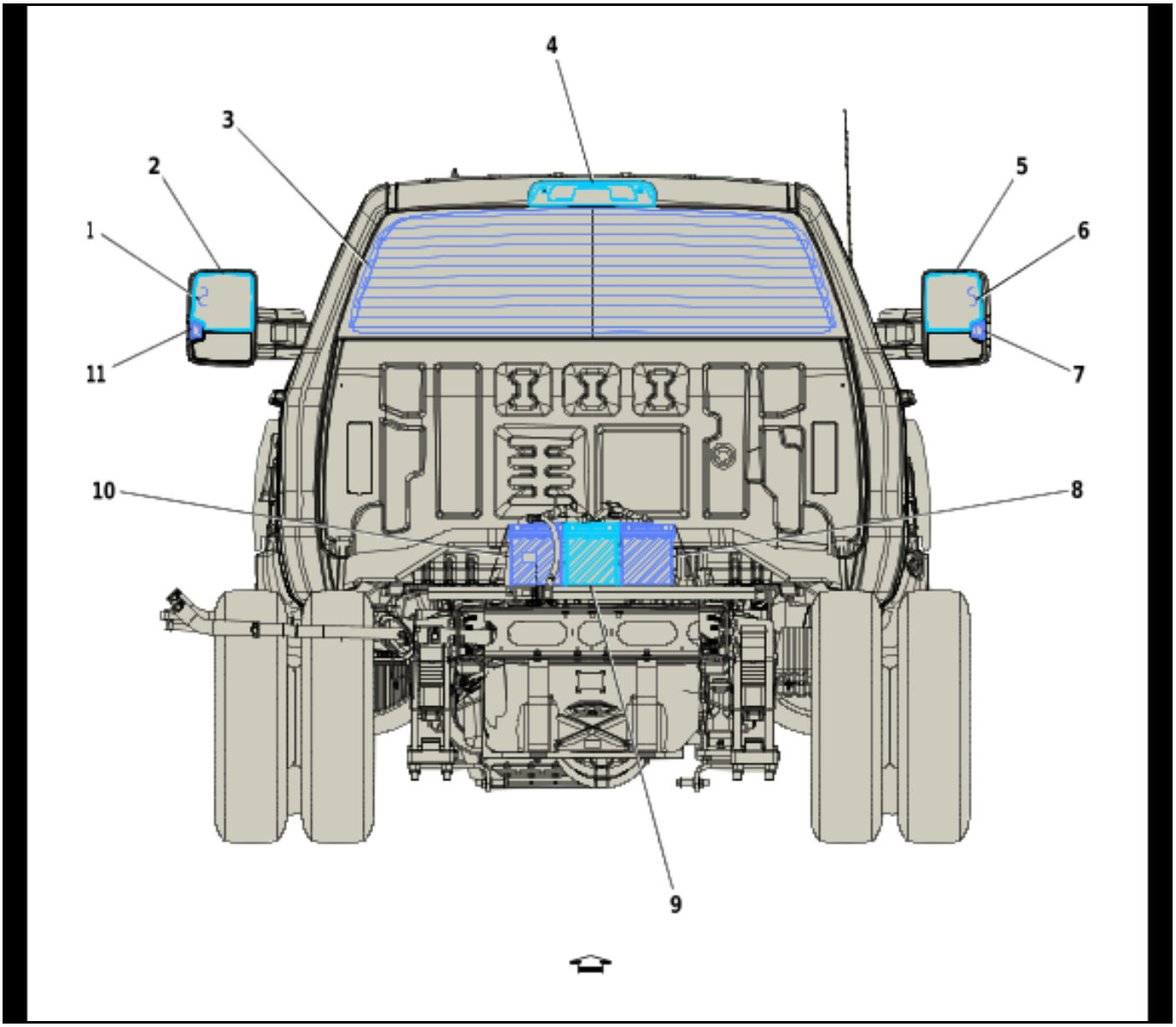
(3) B63RR Side Impact Sensor - Right Rear (Crew Cab)

(4) M74RR Window Motor - Right Rear (Crew Cab)

(5) P19AM Speaker - Right Rear Door (Crew Cab)

Luggage Compartment/Rear of Vehicle Component Views

Rear of Vehicle Components



4976266

Items

(1) E4Y Turn Signal Repeater Lamp - Left (DPN)

(2) E17D Outside Rearview Mirror Glass - Driver (DPN)

(3) E18 Rear Defogger Grid (C49)

(4) E6 Center High Mounted Stop Lamp (T3V)

(5) E17P Outside Rearview Mirror Glass - Passenger (DPN)

(6) E4Z Turn Signal Repeater Lamp - Right (DPN)

(7) E70P Outside Rearview Mirror Cargo Lamp - Passenger (DPN)

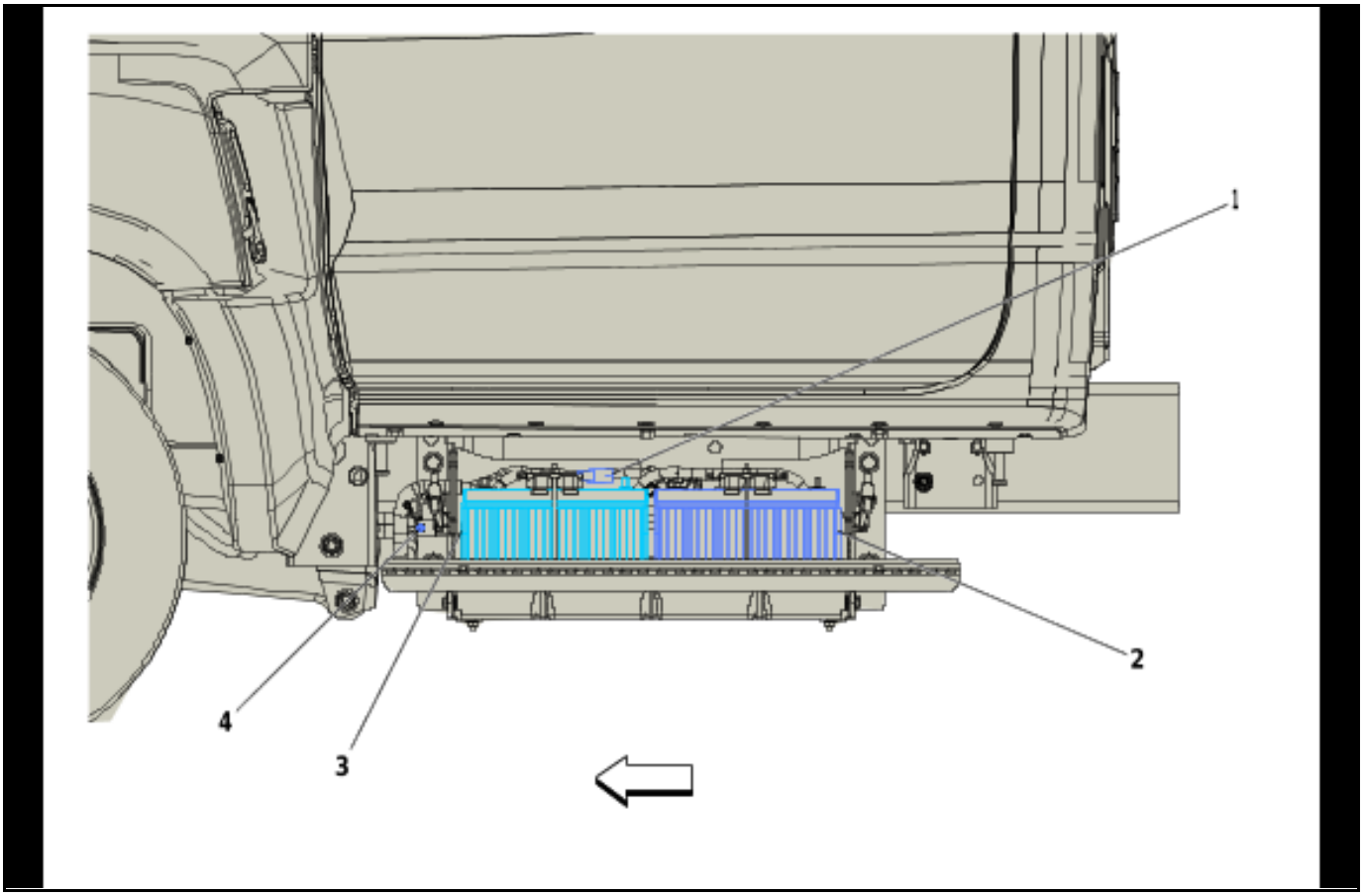
(8) C1BB Battery - Auxiliary 2 (7Y9)

(9) C1BA Battery - Auxiliary 1

(10) C1 Battery

(11) E70D Outside Rearview Mirror Cargo Lamp - Driver (DPN)

Wheels/Vehicle Underbody Component Views
Battery Box Components (7Y7 or 7Y8)

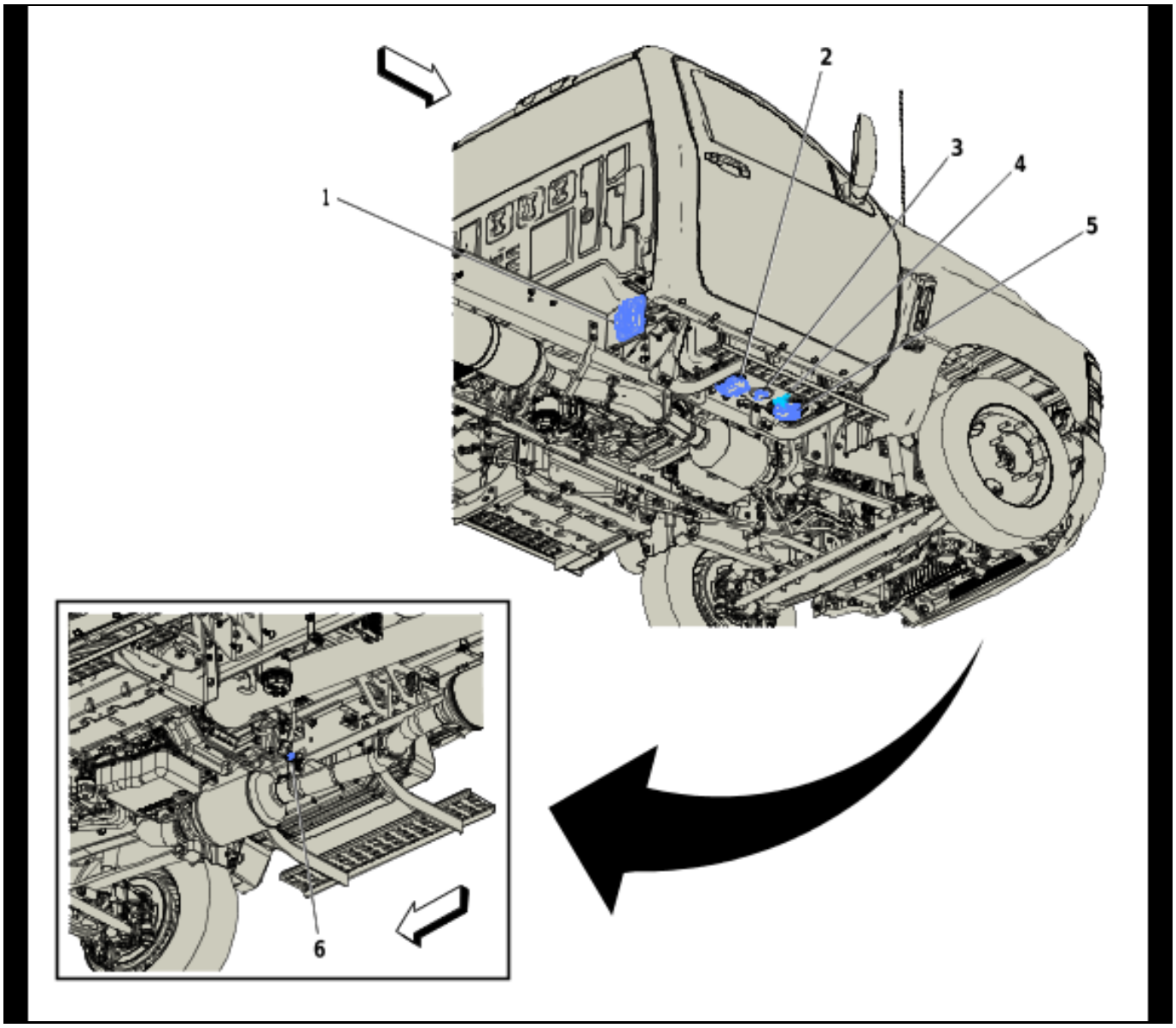


5257814

Items

(1) X55BC Fuse Holder 3 - Brake Booster
(2) C1 Battery
(3) C1BA Battery - Auxiliary 1
(4) W34 Battery Positive Cable Terminal Post - Jump Start (BTN)

Below Right Side of Cab Components

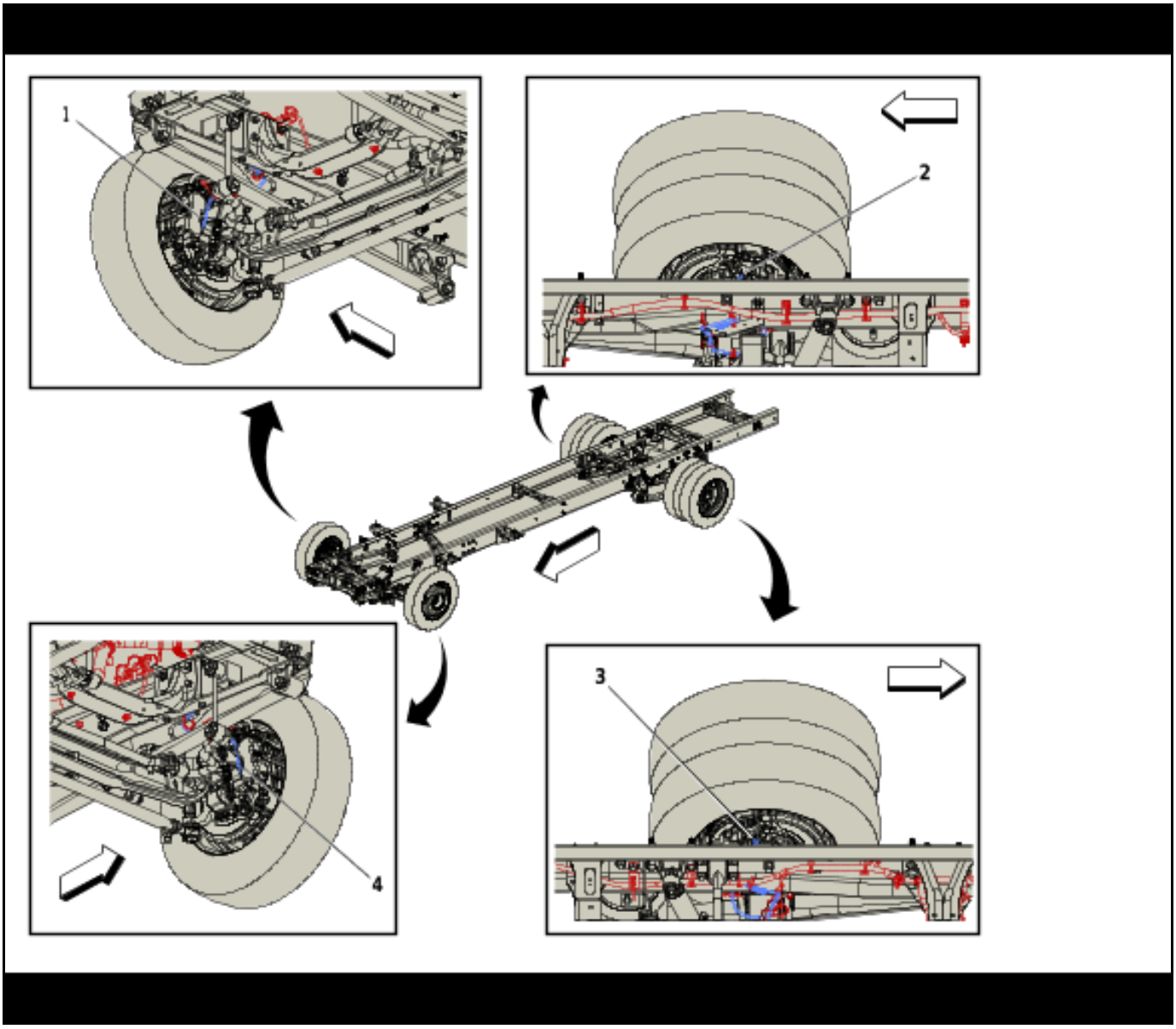


4975703

Items

(1) K44 Power Take-Off Control Module (PTO)
(2) K115 Reductant Control Module
(3) B295 Reductant Quality Sensor
(4) E52 Reductant Line Heater
(5) A38 Reductant Pump and Sensor Assembly
(6) Q61 Reductant Injector

Wheel Speed Sensors - 2WD (-NQF)

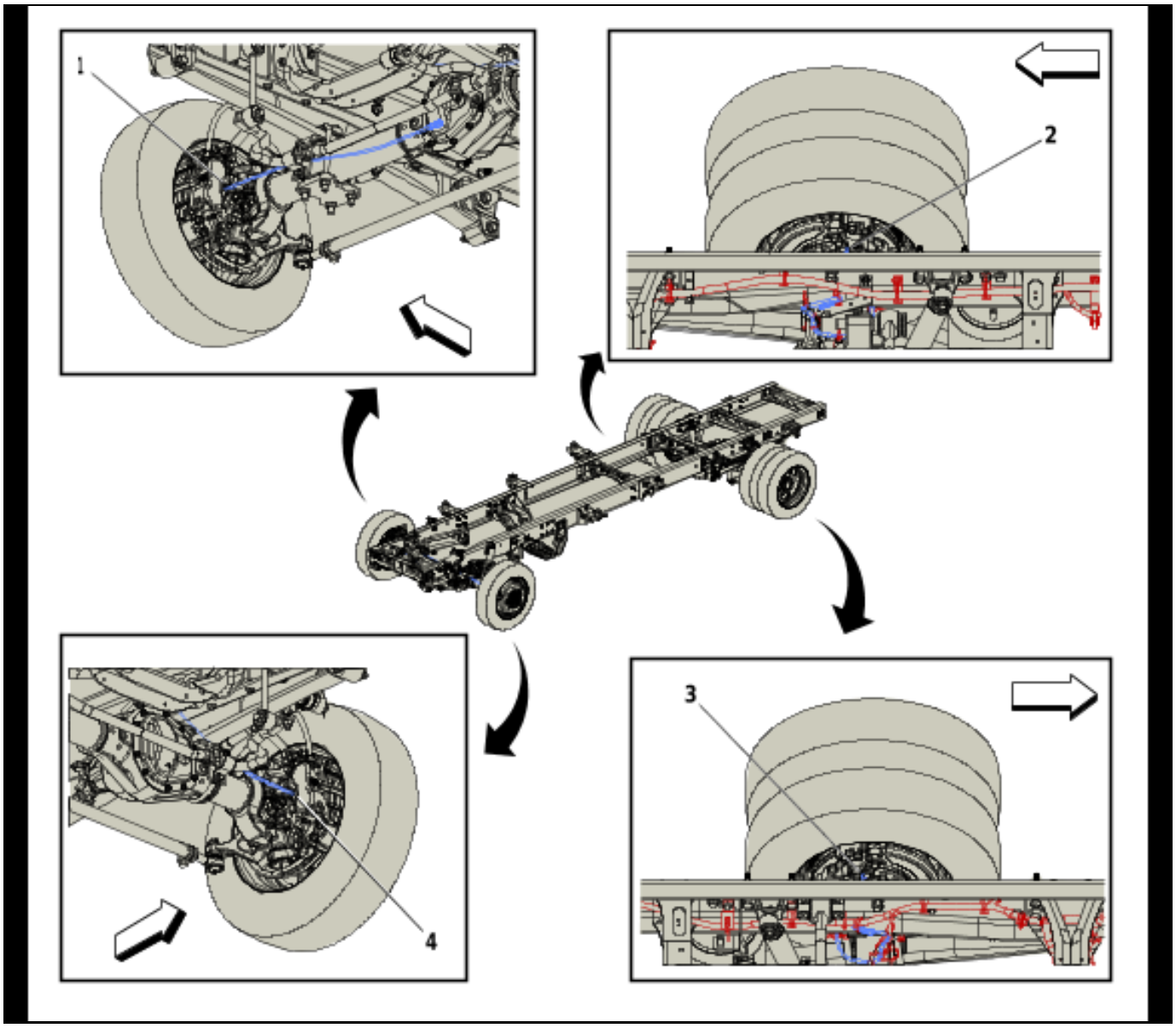


5257817

Items

(1) B5RF Wheel Speed Sensor - Right Front
(2) B5RR Wheel Speed Sensor - Right Rear
(3) B5LR Wheel Speed Sensor - Left Rear
(4) B5LF Wheel Speed Sensor - Left Front

Wheel Speed Sensors - 4WD (NQF)

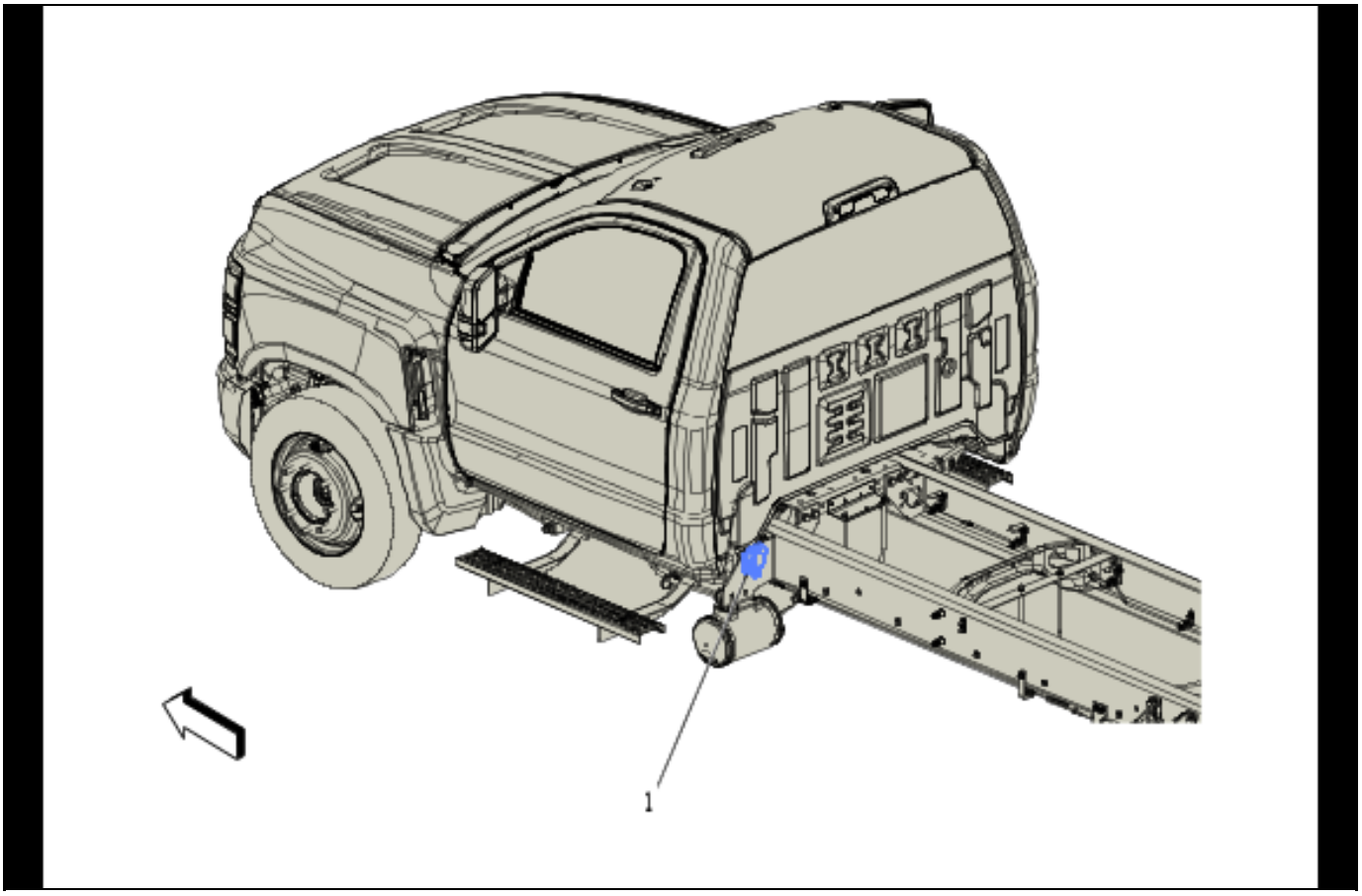


5257822

Items

(1) B5RF Wheel Speed Sensor - Right Front
(2) B5RR Wheel Speed Sensor - Right Rear
(3) B5LR Wheel Speed Sensor - Left Rear
(4) B5LF Wheel Speed Sensor - Left Front

Fuel Pump Driver Control Module (PTO)

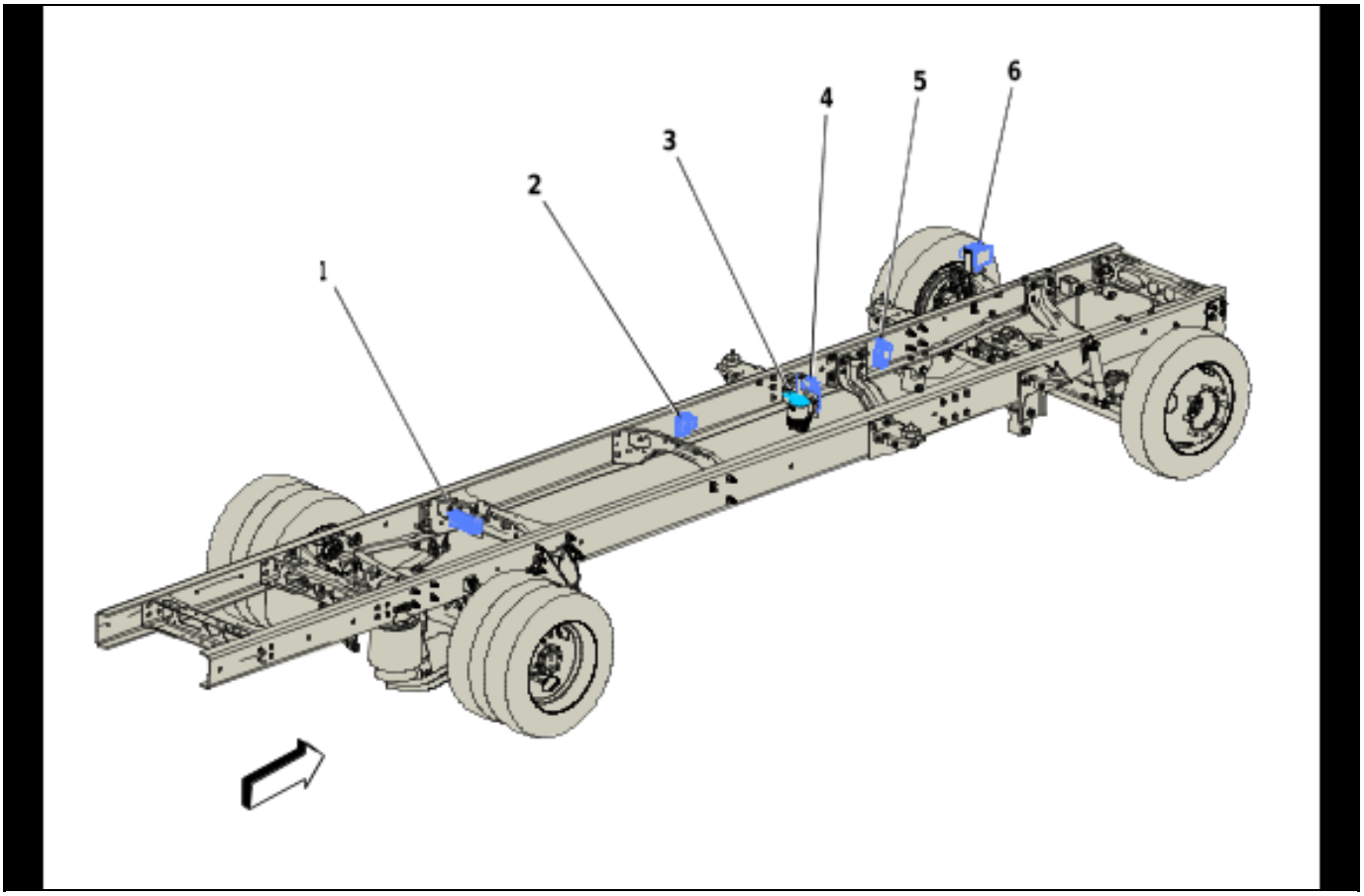


5388103

Items

(1) K111 Fuel Pump Driver Control Module

Left Side of Frame Components



5904736

Items

(1) Q101 Rear Air Suspension Control Valve (JPZ)

(2) K133 Trailer Brake Power Control Module (JL1)

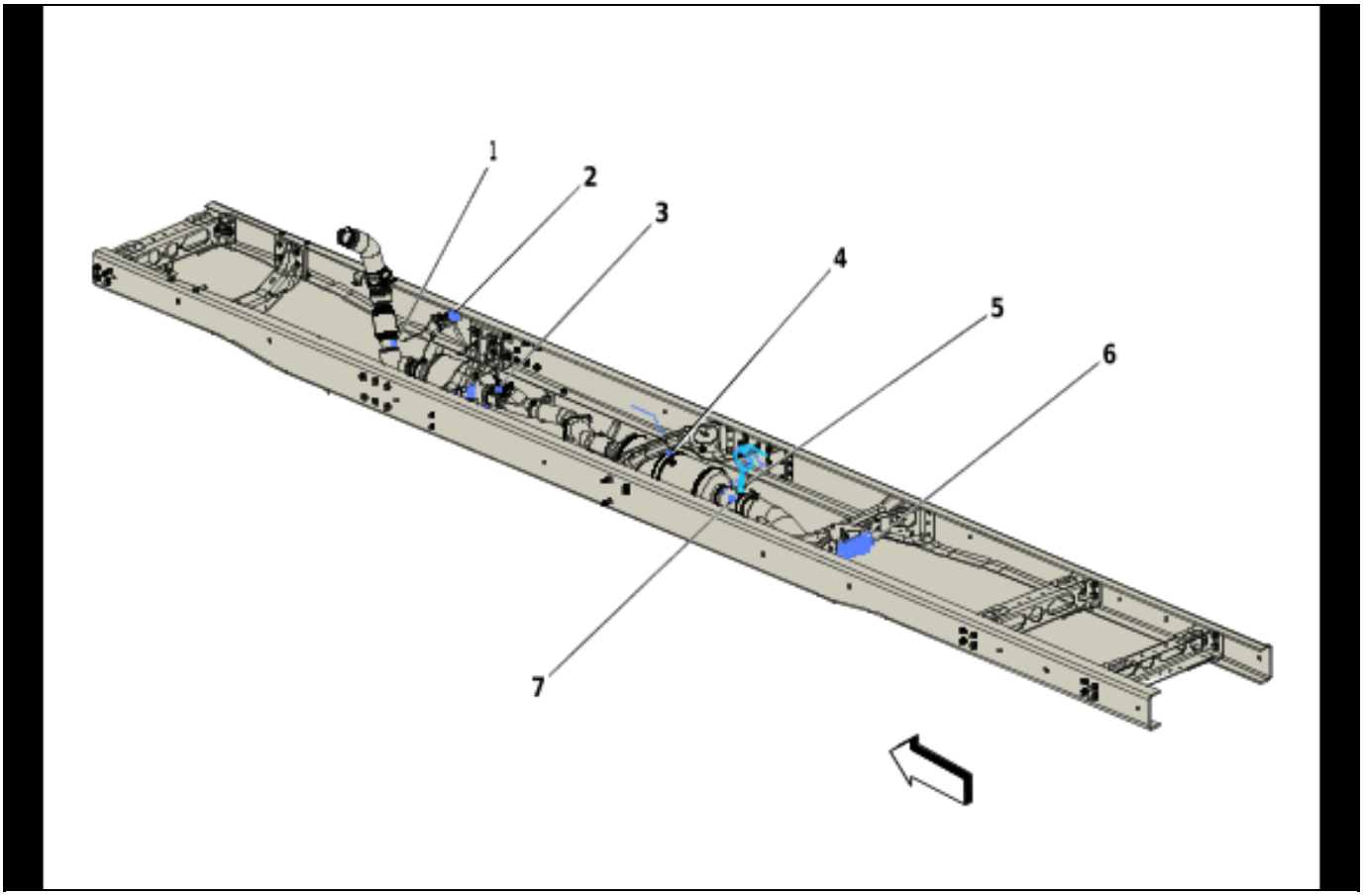
(3) E11A Fuel Heater/Water in Fuel Sensor

(4) K38A Chassis Control Module - Auxiliary (JL1)

(5) K111 Fuel Pump Driver Control Module

(6) K17 Electronic Brake Control Module

Right Side of Frame Components

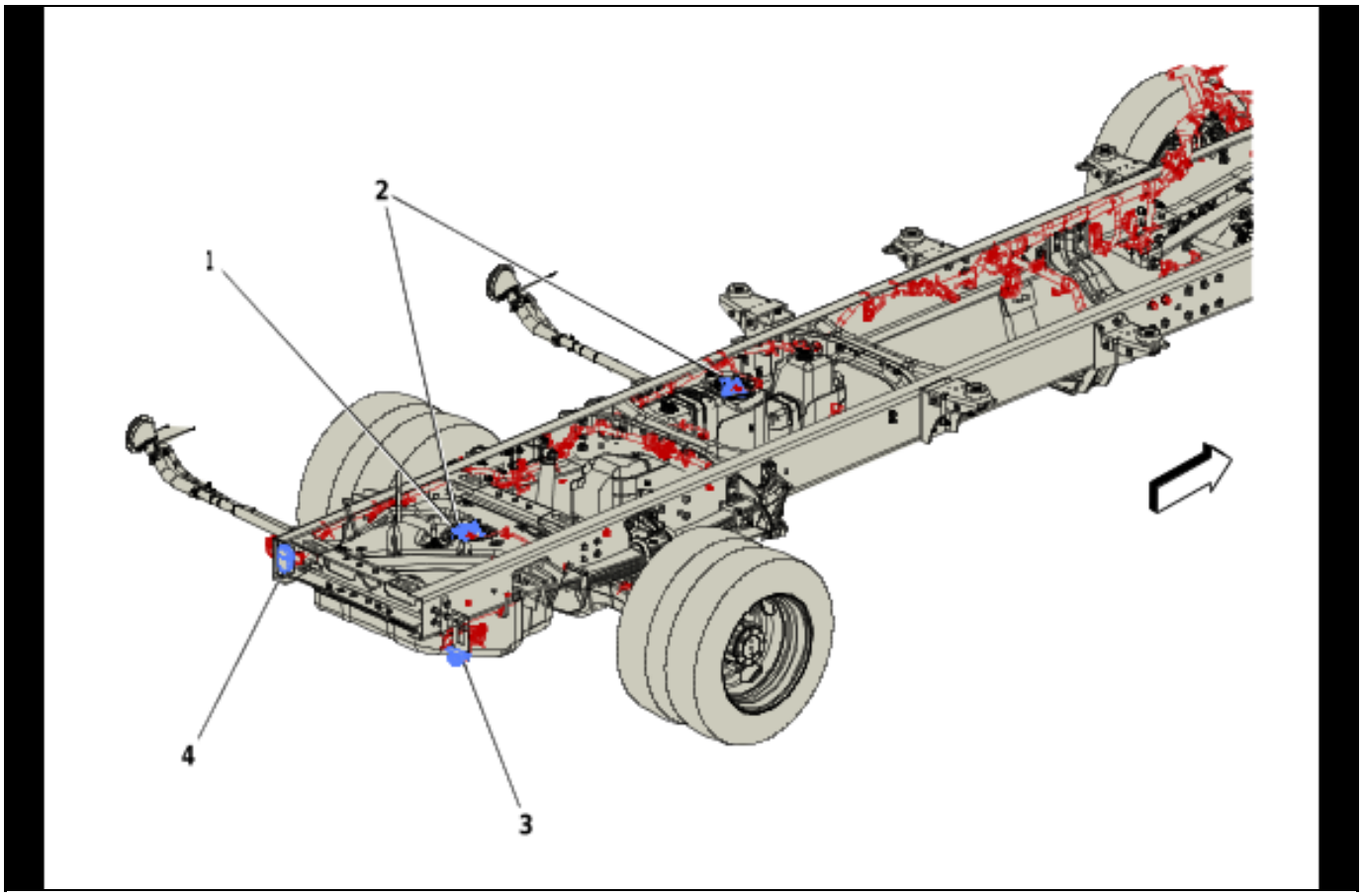


5278620

Items

(1) B131C Exhaust Temperature Sensor 3
(2) B154 Diesel Particulate Filter Exhaust Differential Pressure Sensor
(3) B131D Exhaust Temperature Sensor 4
(4) B131E Exhaust Temperature Sensor 5
(5) B136 Exhaust Particulate Matter Sensor
(6) Q101 Rear Air Suspension Control Valve (JPZ)
(7) B195B Nitrogen Oxides Sensor 2

Rear of Frame Components



5257829

Items

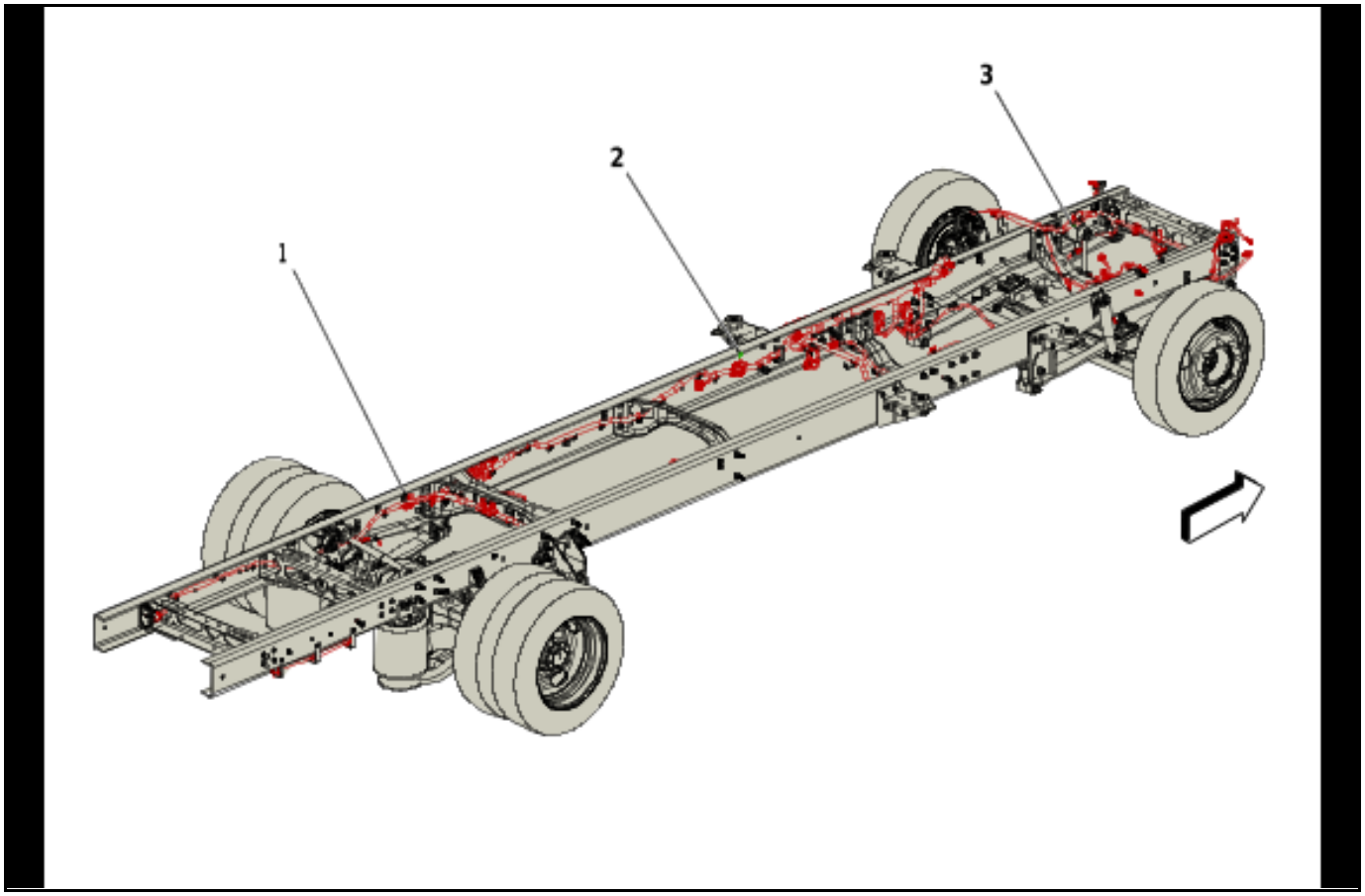
(1) A6D Fuel Pump and Level Sensor Assembly - Secondary (NSQ)

(2) A6C Fuel Pump and Level Sensor Assembly - Primary

(3) P3 Backup Alarm (UZF)

(4) X88 Trailer Connector (UY7)

Ground Views
G101, G399 and G401



4992545

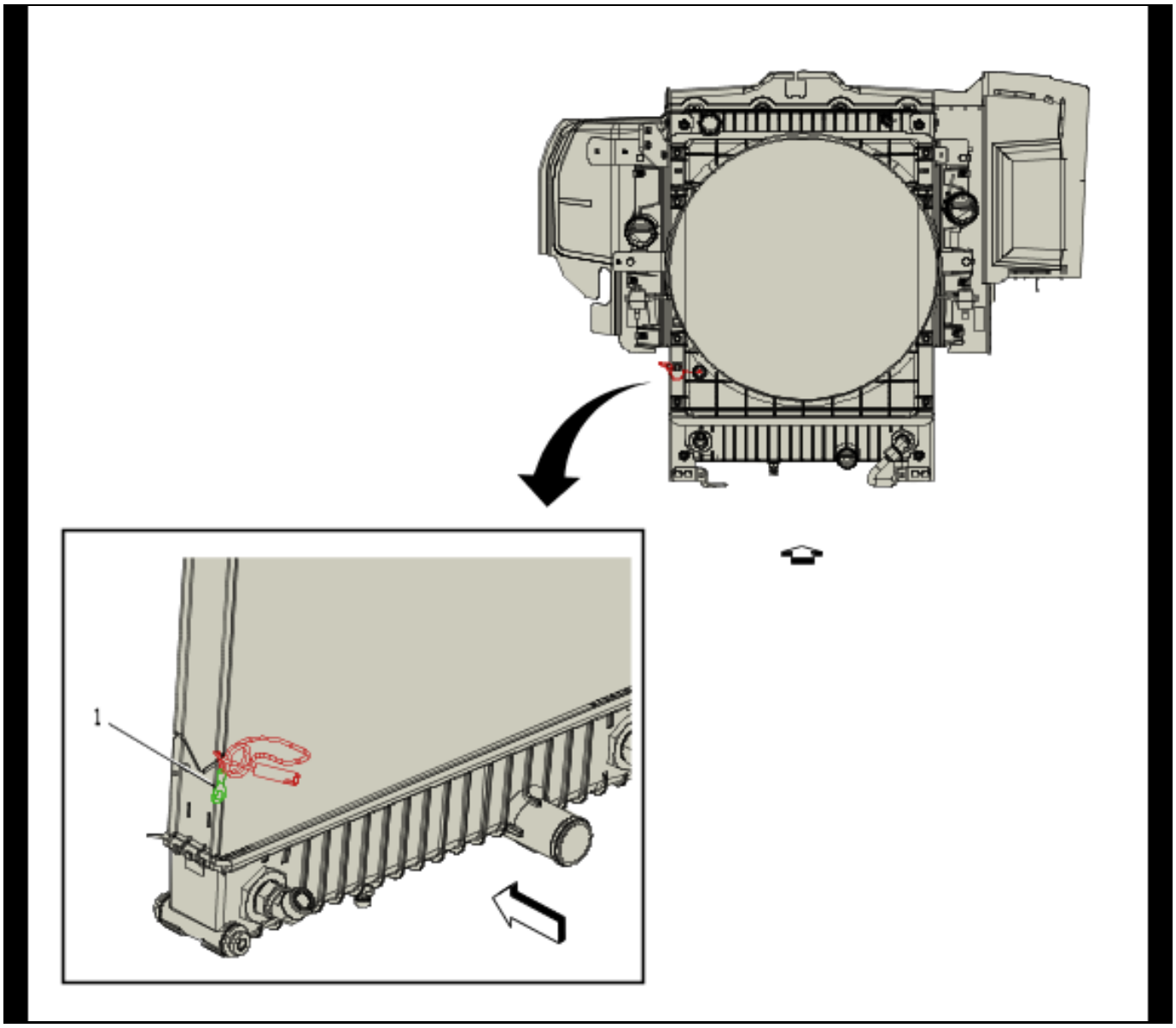
Items

(1) G401 Chassis Rear Wiring Harness - Left

(2) G399 Chassis Front Wiring Harness, Ground Cable - Frame

(3) G101 Body Front and Engine Wiring Harness

G102

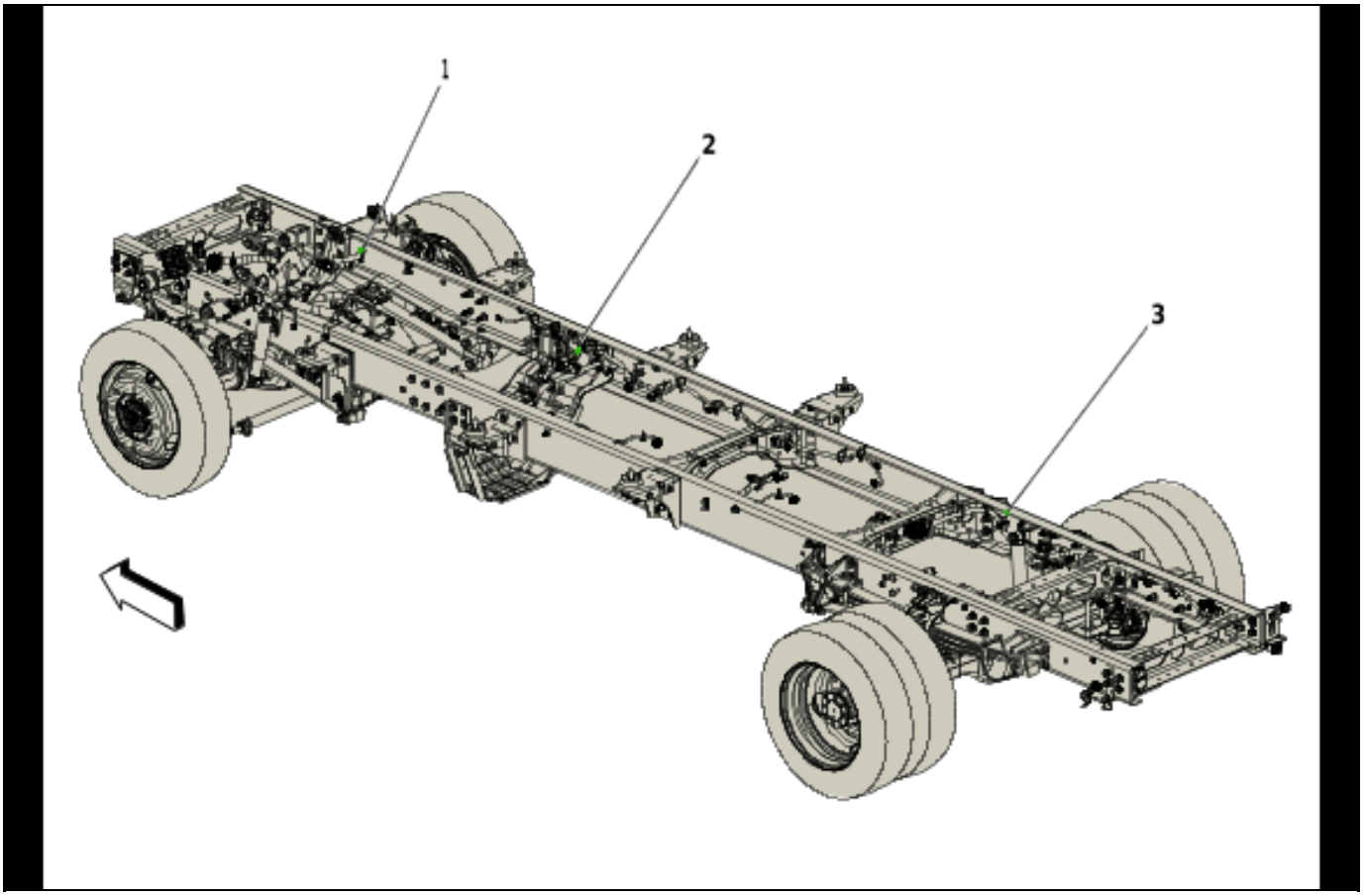


5257838

Items

(1) G102 Radiator Ground Harness

G108, G398 and G402

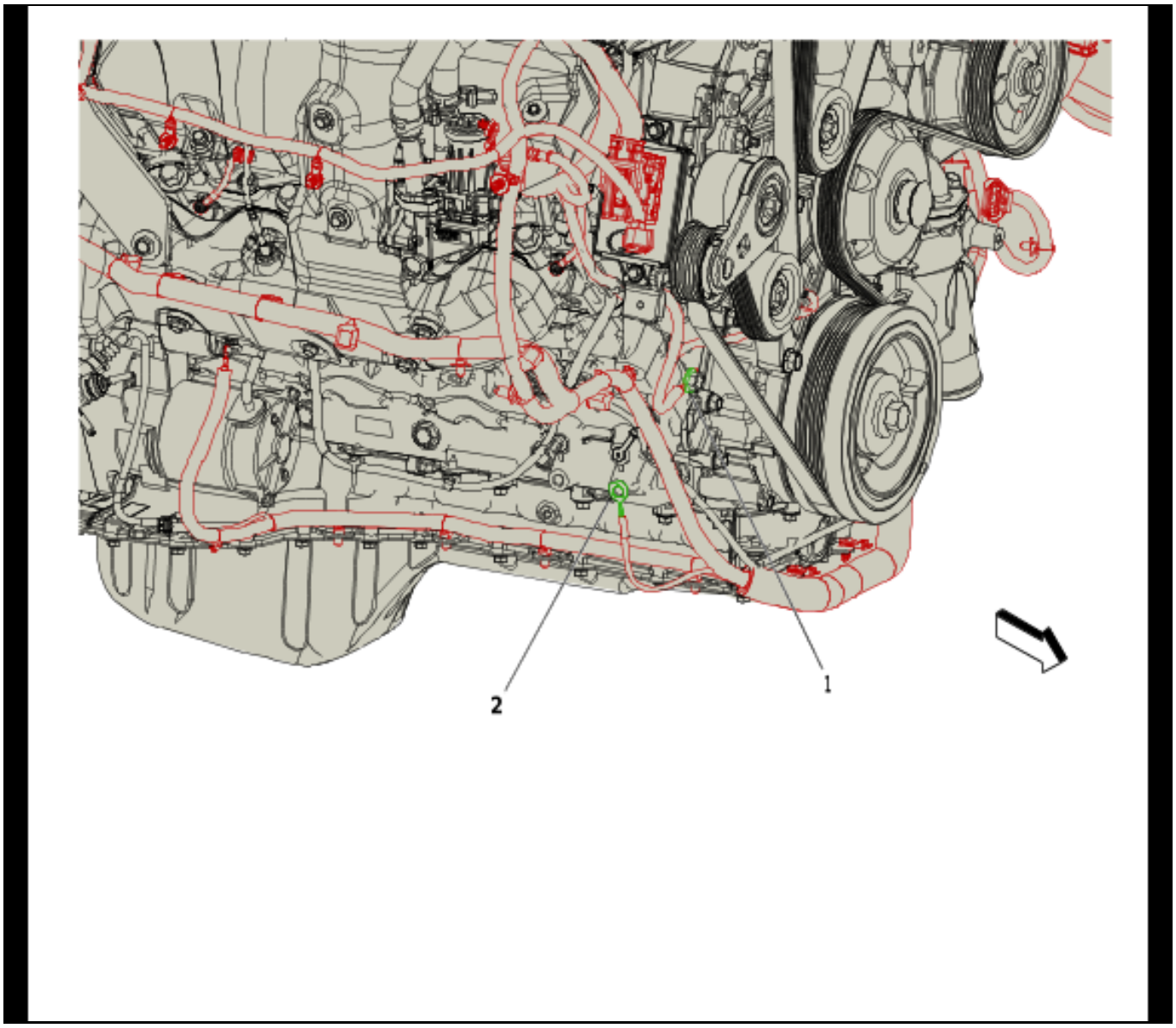


4975590

Items

(1) G108 Ground Cable - Engine
(2) G398 Ground Cable - Frame
(3) G402 Chassis Rear Wiring Harness - Right

G110 and G112



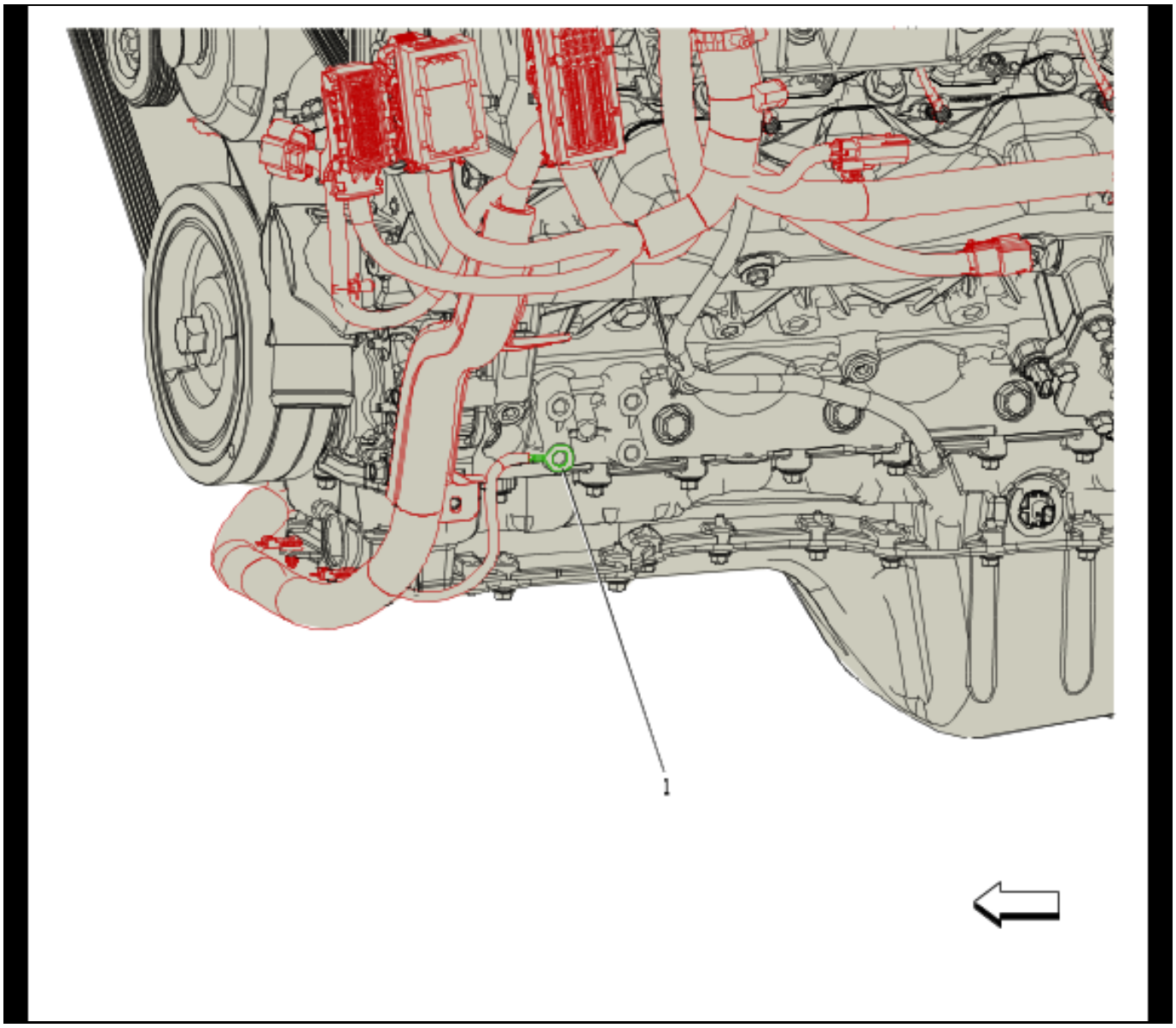
4975575

Items

(1) G112 Engine Wiring Harness

(2) G110 Engine Wiring Harness - Chassis, Ground Cable - Engine

G120

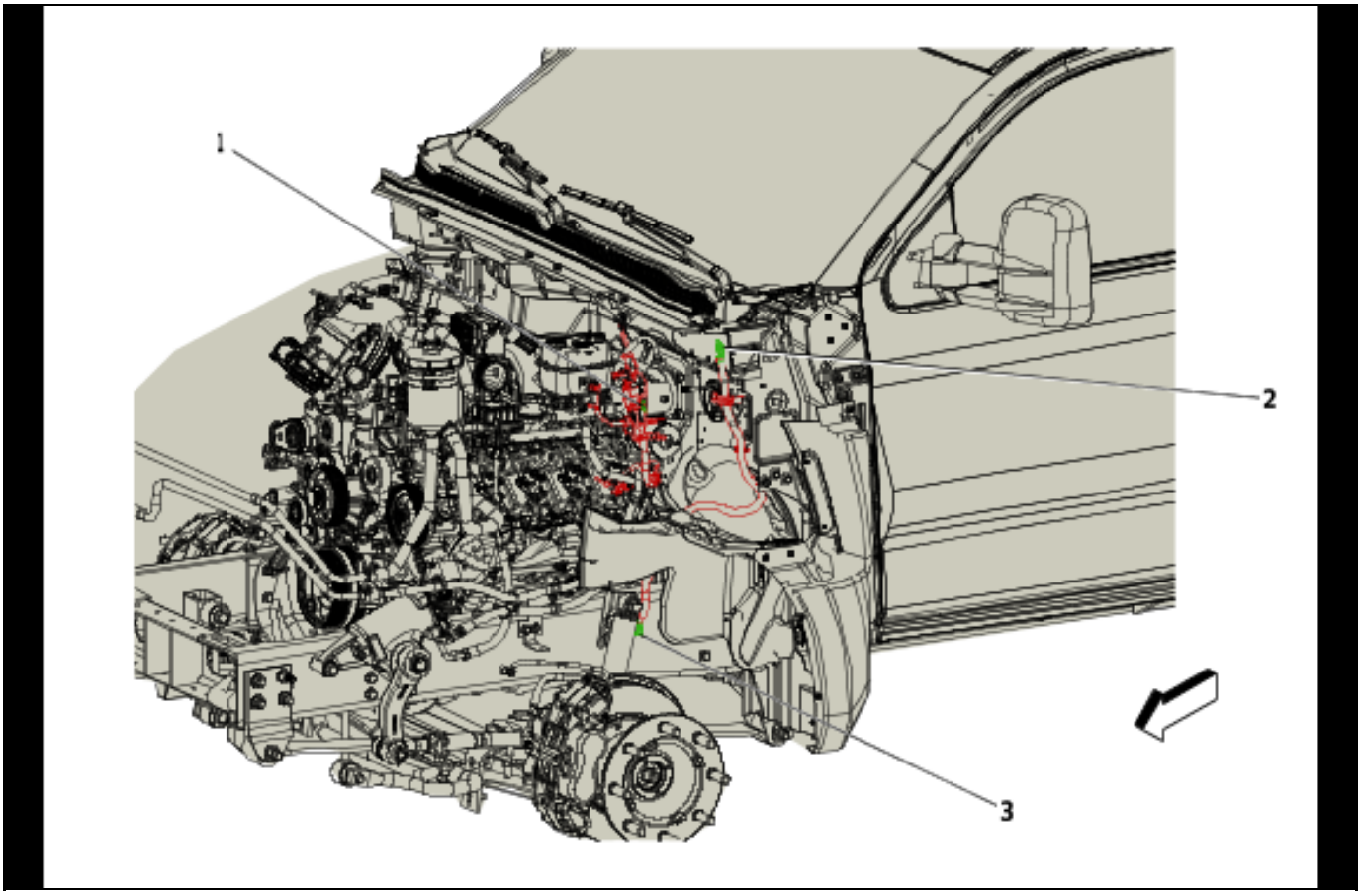


4975578

Items

(1) G120 Engine Wiring Harness - Chassis

G180, G198 and G199

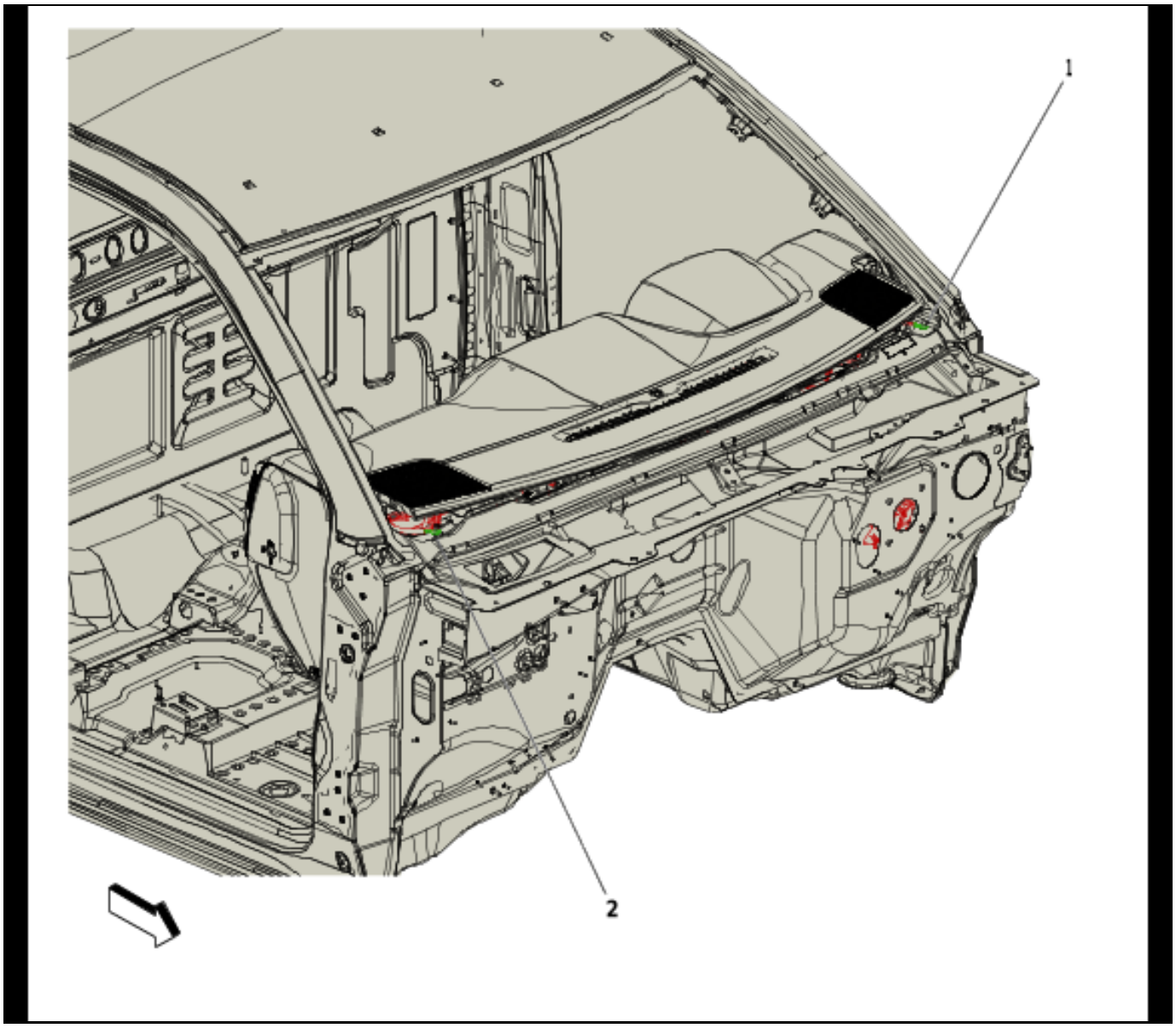


5257833

Items

(1) G180 Brake Pedal Position Sensor Harness
(2) G198 Ground Cable - Body
(3) G199 Ground Cable - Body

G210 and G218

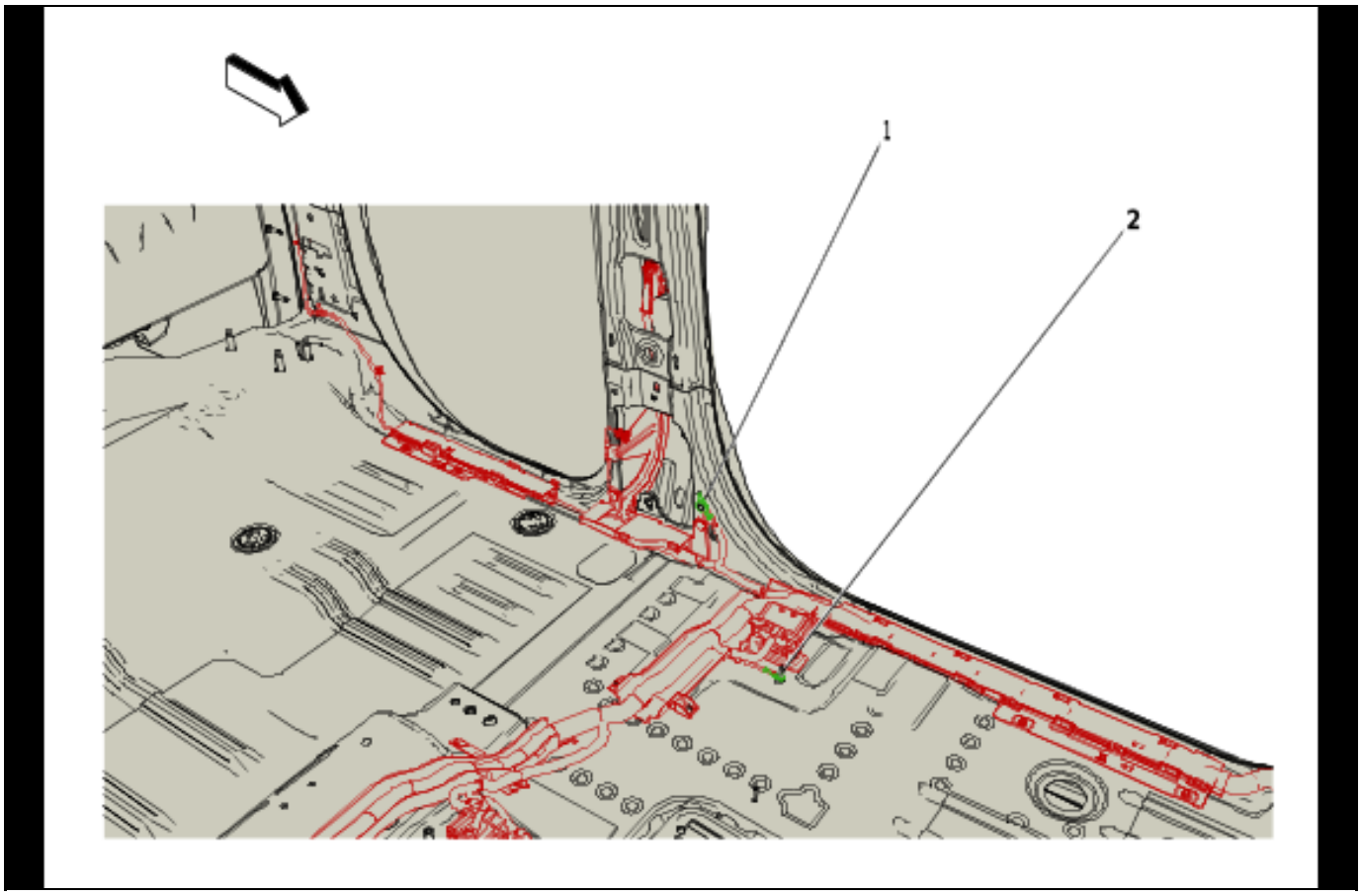


4975581

Items

(1) G218 Instrument Panel Wiring Harness
(2) G210 Instrument Panel Wiring Harness

G311 and G325



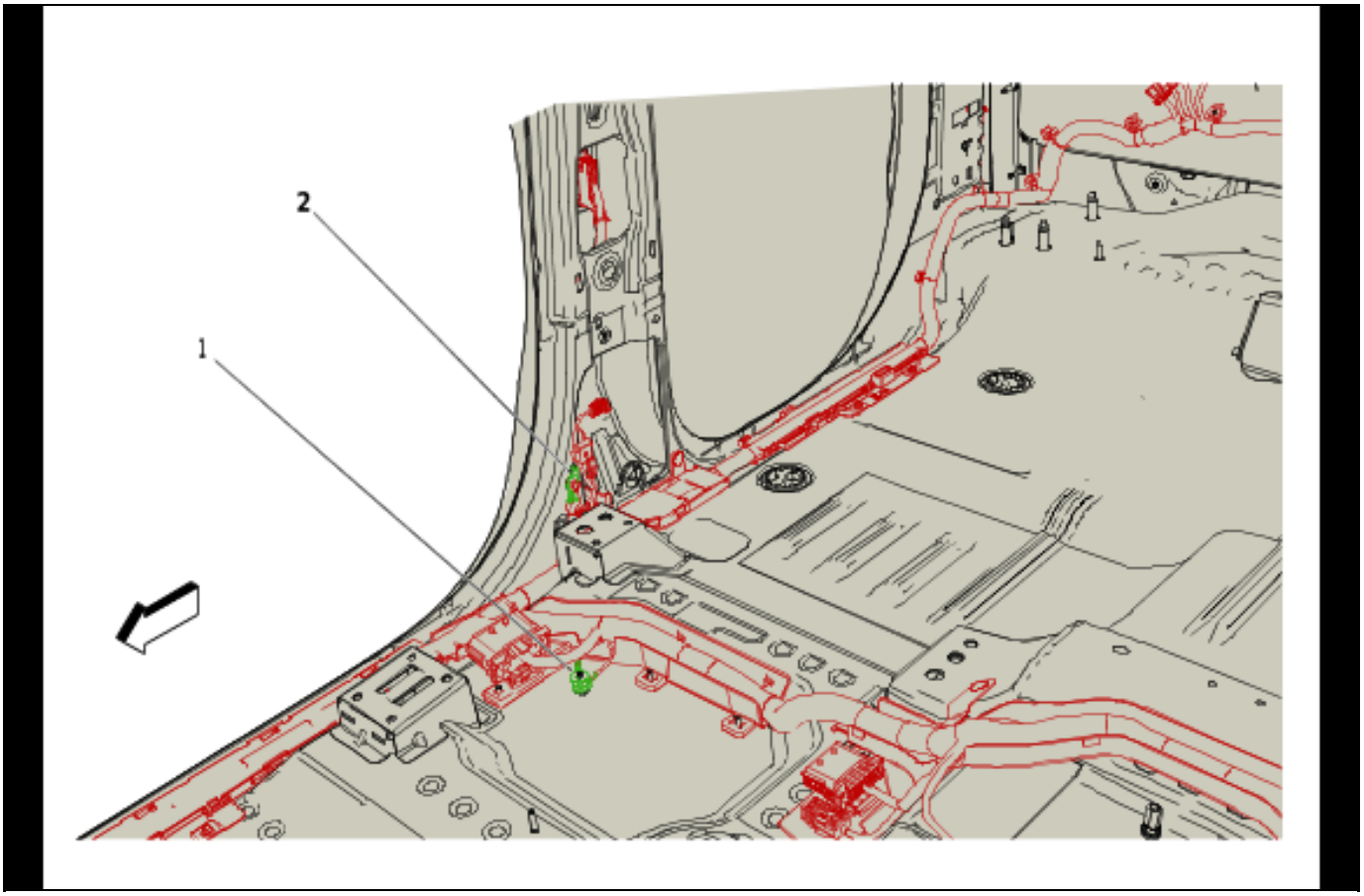
4975585

Items

(1) G311 Body Wiring Harness

(2) G325 Body Wiring Harness

G312 and G327



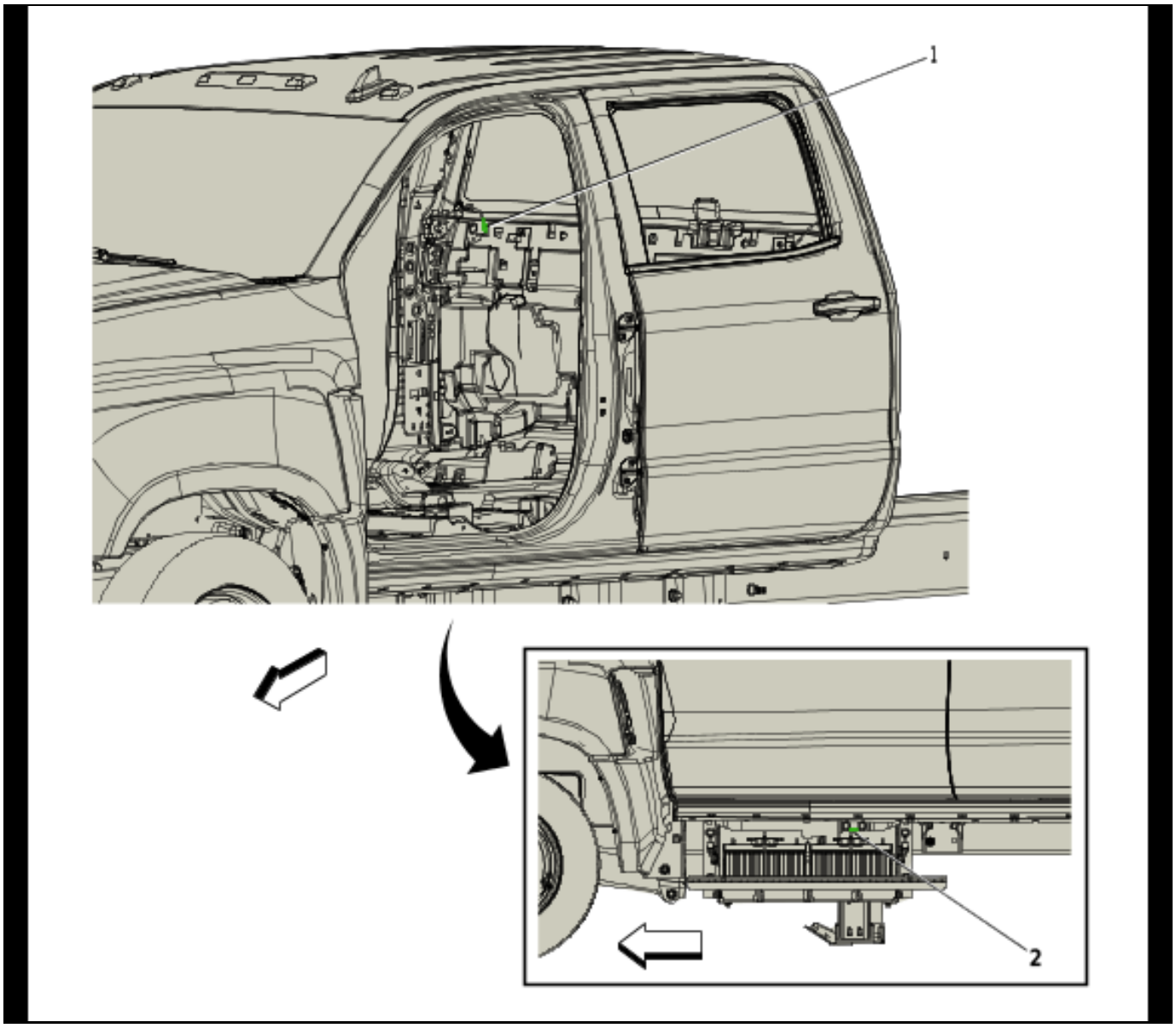
4975588

Items

(1) G327 Body Wiring Harness

(2) G312 Body Wiring Harness

G340 and G380



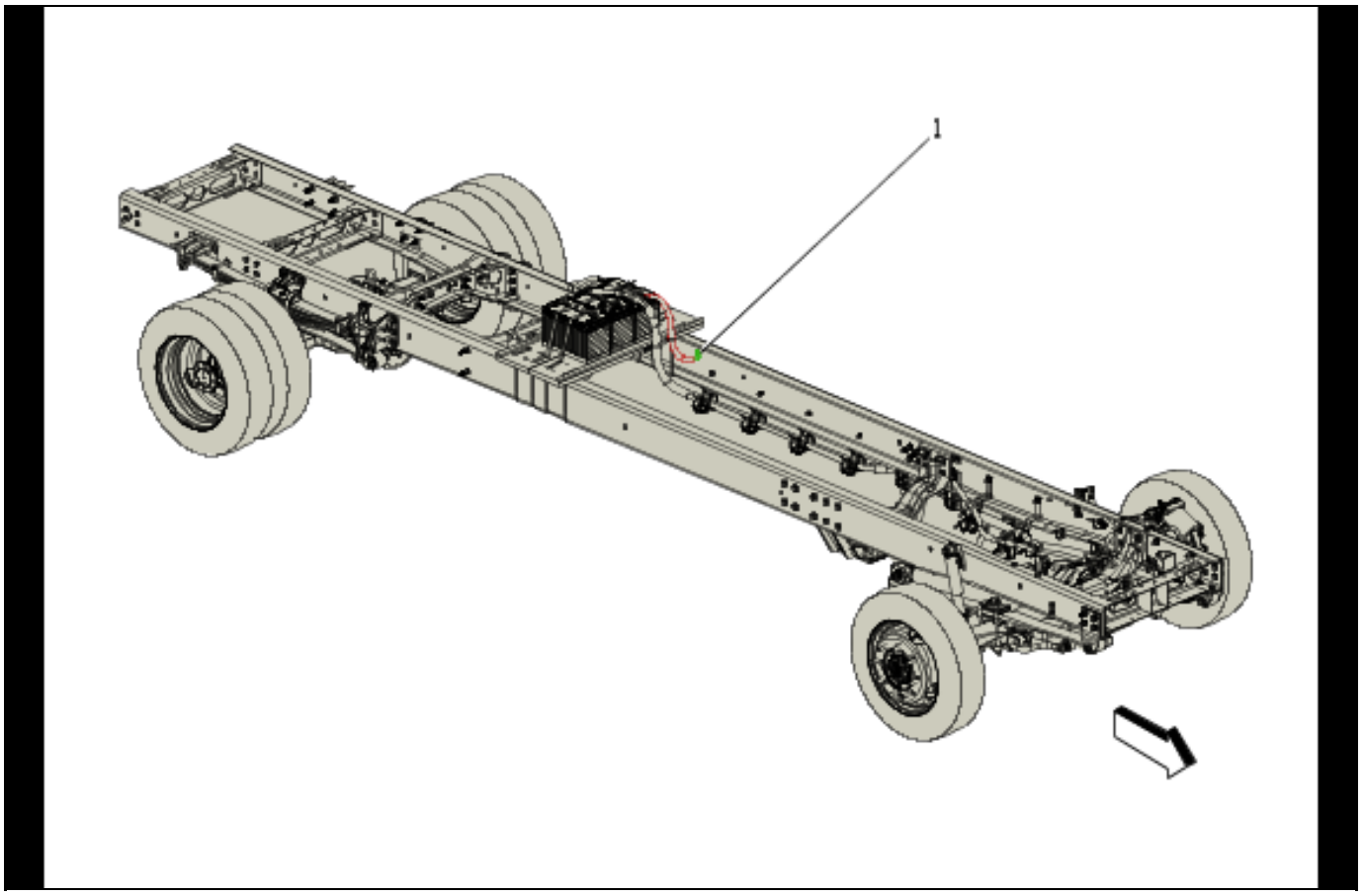
5257839

Items

(1) G380 Rear Defogger Grid (C49)

(2) G340 Battery Negative Cable - Battery (7Y7/ 7Y8)

G440 (Left Frame Rail)

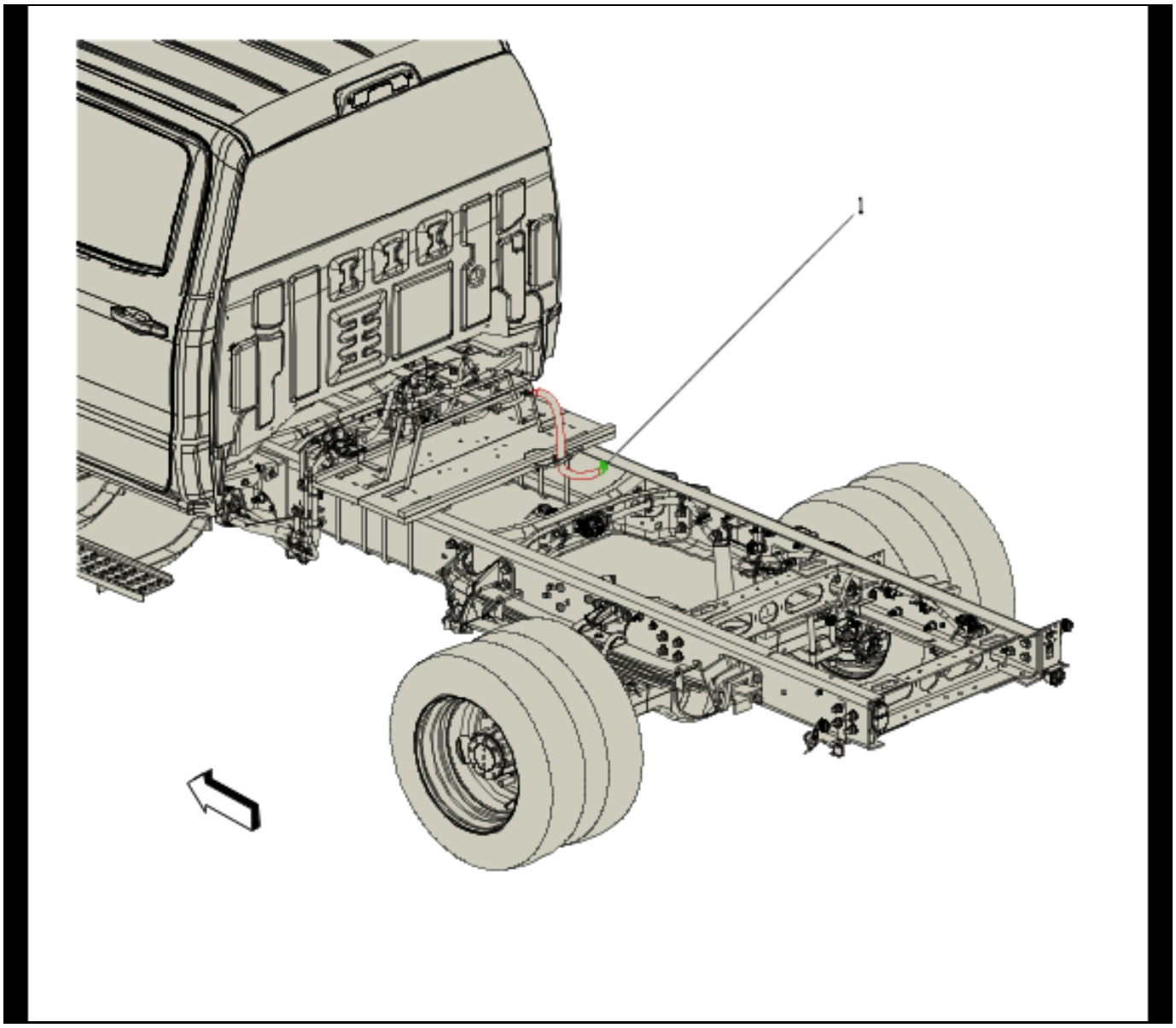


5314145

Items

(1) G440 Battery Negative Cable - Battery (7Y9)

G440 (Right Frame Rail)



5314146

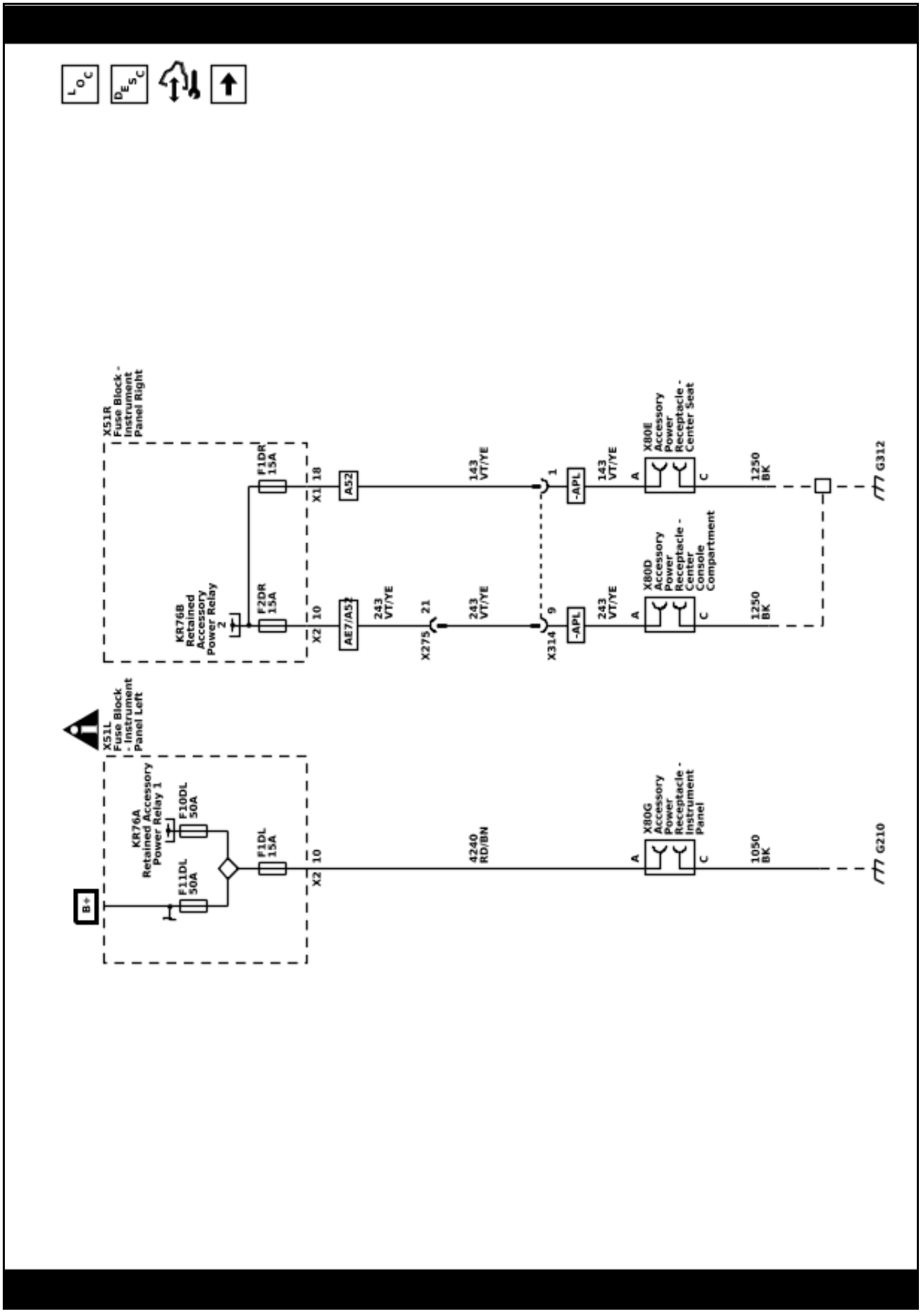
Items

(1) G440 Battery Negative Cable - Battery (7Y9)

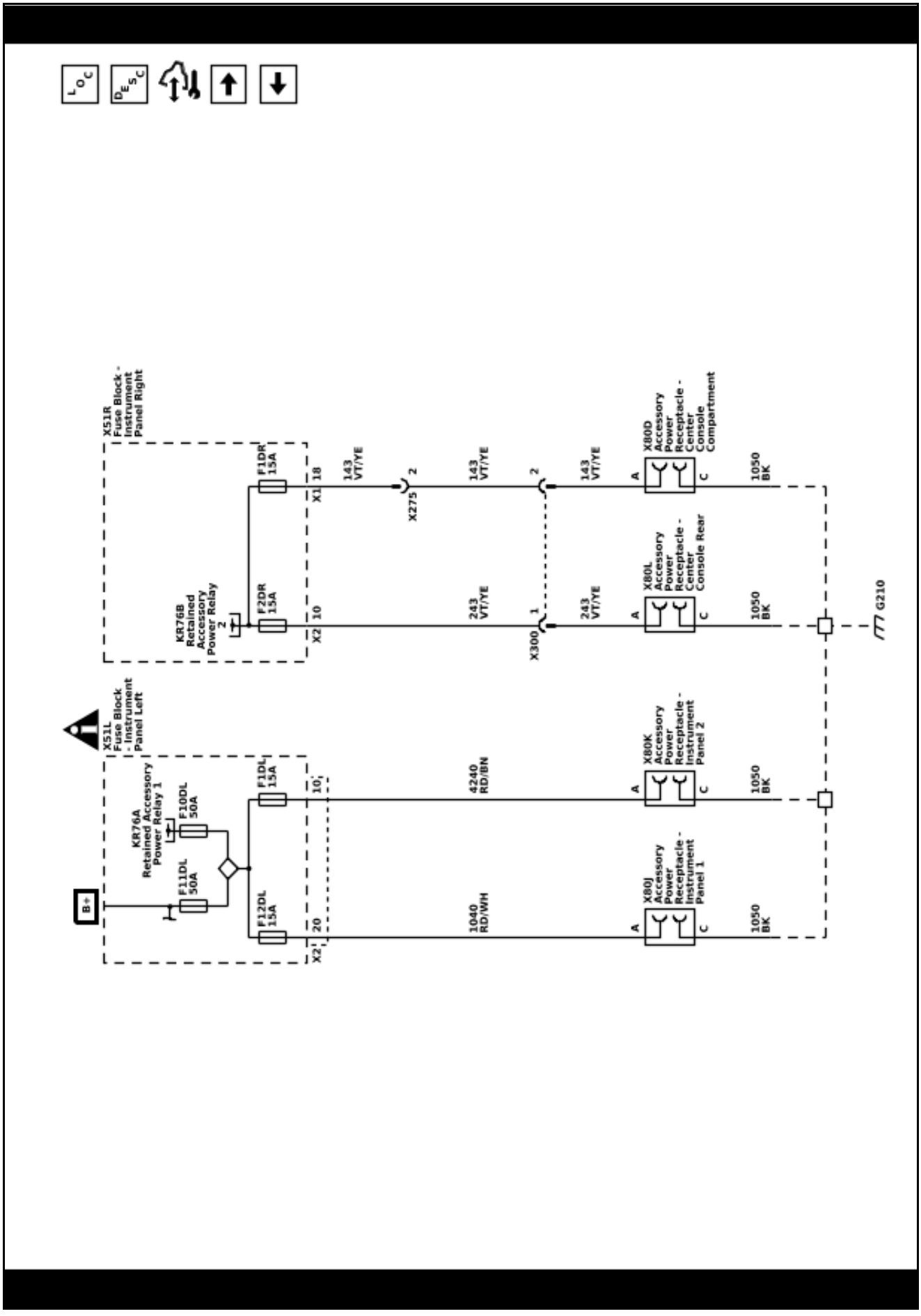
Power Outlets

Schematic and Routing Diagrams

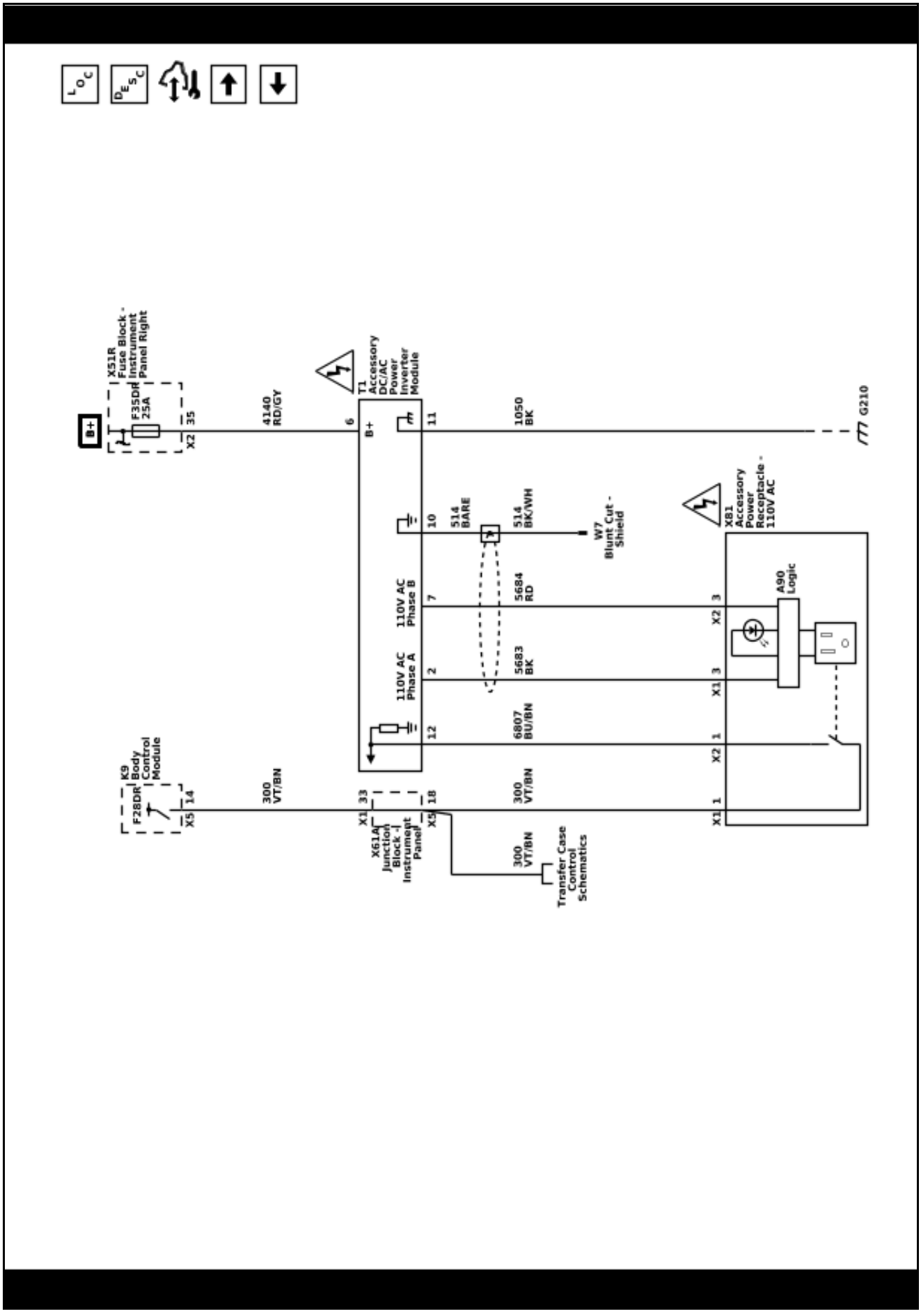
Cigar Lighter/Power Outlet Schematics (12-Volt DC Power Outlets - Bench Seat (-D07))



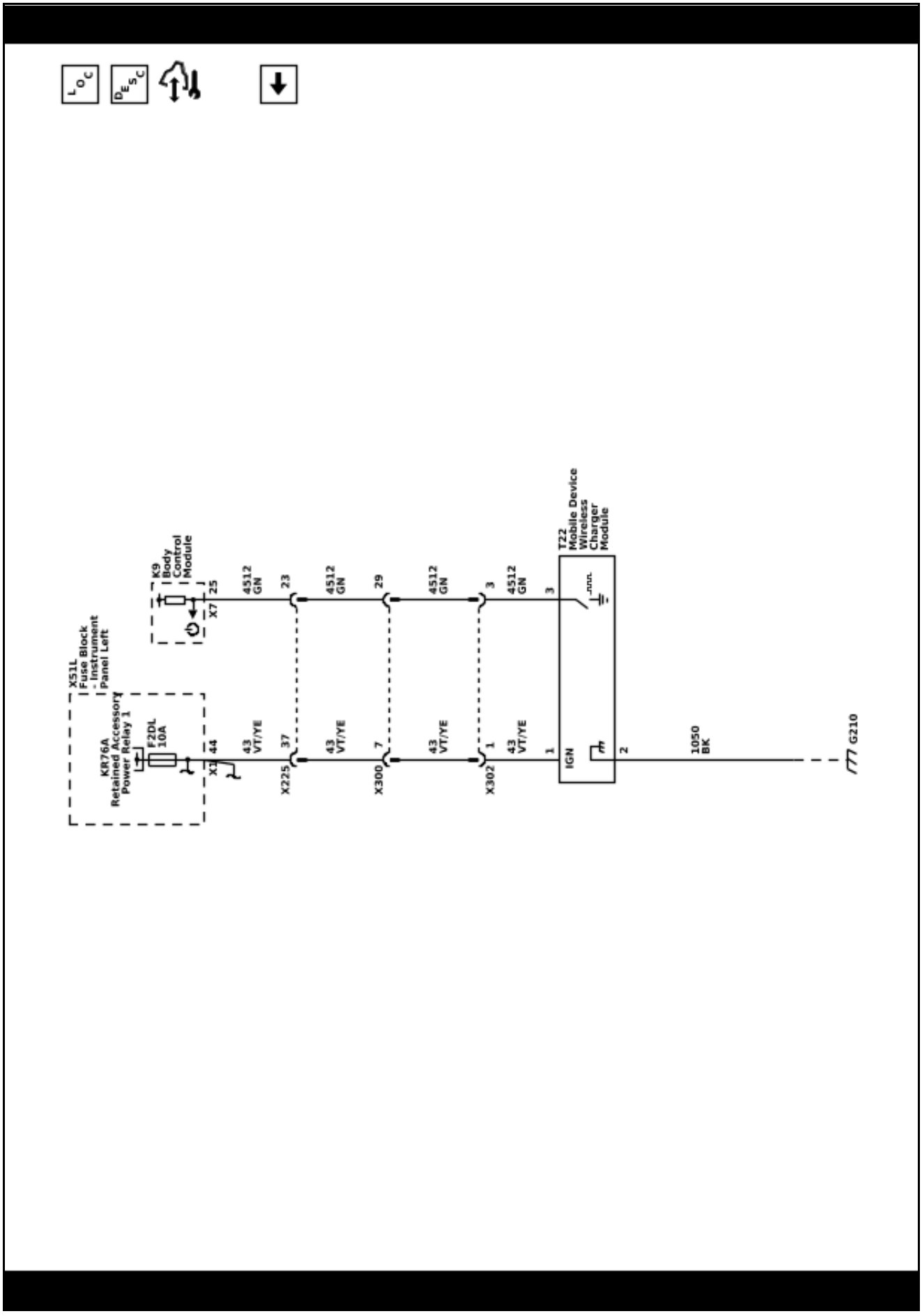
Cigar Lighter/Power Outlet Schematics (12-Volt DC Power Outlets - Floor Console (D07))



Cigar Lighter/Power Outlet Schematics (110-Volt AC Power Outlet (KI4))

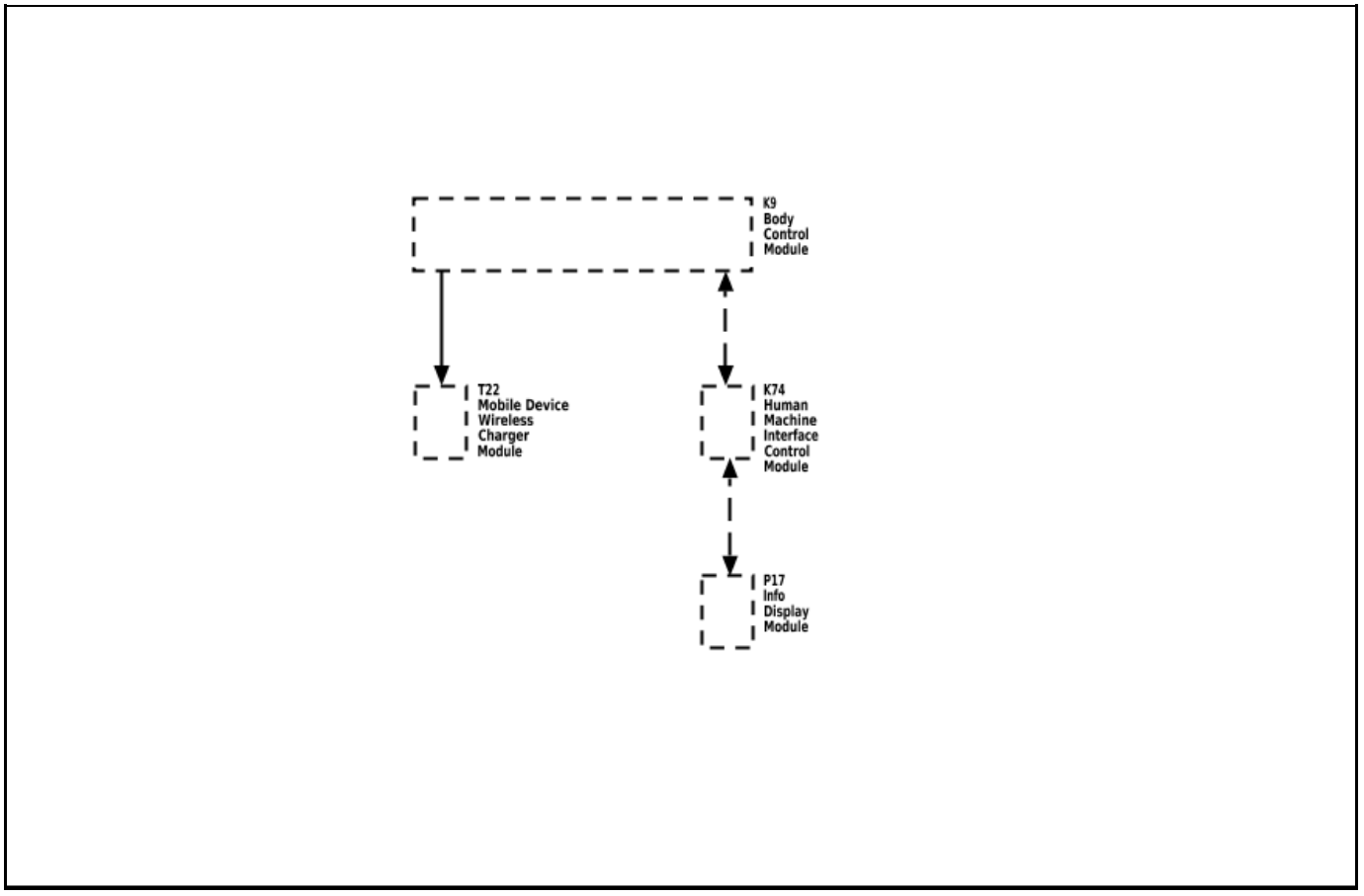


Cigar Lighter/Power Outlet Schematics (Wireless Charging (K4C))



Description and Operation
Mobile Device Wireless Charger Description and Operation
Mobile Device Wireless Charging System

Mobile Device Wireless Charging System Block Diagram



3607745

The Mobile Device Wireless Charging System (WCS) is an system for wirelessly charging mobile devices. It is capable of charging the batteries of compatible mobile devices. A compatible device is one that is compliant with Power Matters Alliance (PMA) or Wireless Power Consortium (WPC) Standard, meaning that it is equipped with a PMA or WPC wireless charge “receiver” that will work with the charge “transmitter” installed in the vehicle. The devices may utilize built-in charging circuitry or an adapter (external plug-in device which contains the charging circuitry). To check for phone or other device compatibility, refer to GM Total Connect.

Warning: Remove all objects from the charging pad before charging your mobile device. Objects, such as coins, keys, rings, paper clips, or cards, between the phone and charging pad will become very hot. On the rare occasion that the charging system does not detect an object, and the object gets wedged between the phone and charger, remove the phone and allow the object to cool before removing it from the charging pad, to prevent burns.

Charging

To charge a device, place it on the charging surface in the vehicle. There is a charging coil located in the center of the charging surface. The device has a charging coil typically near the center of the device. These coils must be lined up in order for charging to proceed. When the interruptible retained accessory power (IRAP) relay is closed (this is true typically when vehicle ignition is in Run or Accessory position), the WCS will detect the device, establish communications with the device to confirm it is a compatible device, and then deliver charging power to the device via wireless interface. The WCS will be able to deliver up to 5W of power to compatible devices. It shall only enter a charging state if communication is established and a compatible device is identified.

The WCS shall not enter a charging state if there is no communication established with a compatible device. If a non-compatible device or metallic foreign object is detected, the WCS will not transfer power. The charger monitors its internal temperature and will shut down if the charger temperature exceeds 185F (85C).

Indicator

The body control module will detect the device battery is charging and send a serial data message on the GMLAN bus to the radio display. The radio display will indicate a device is currently charging. When the indicator is toggling on and off this indicates a thermal limit has been reached and the device will not charge. For more information refer to the owners manual.

Cooling

The wireless charger is kept cool using the HVAC system. There is a dedicated HVAC duct that connects to the Wireless Charging Module bracket (which holds the module and the mat).

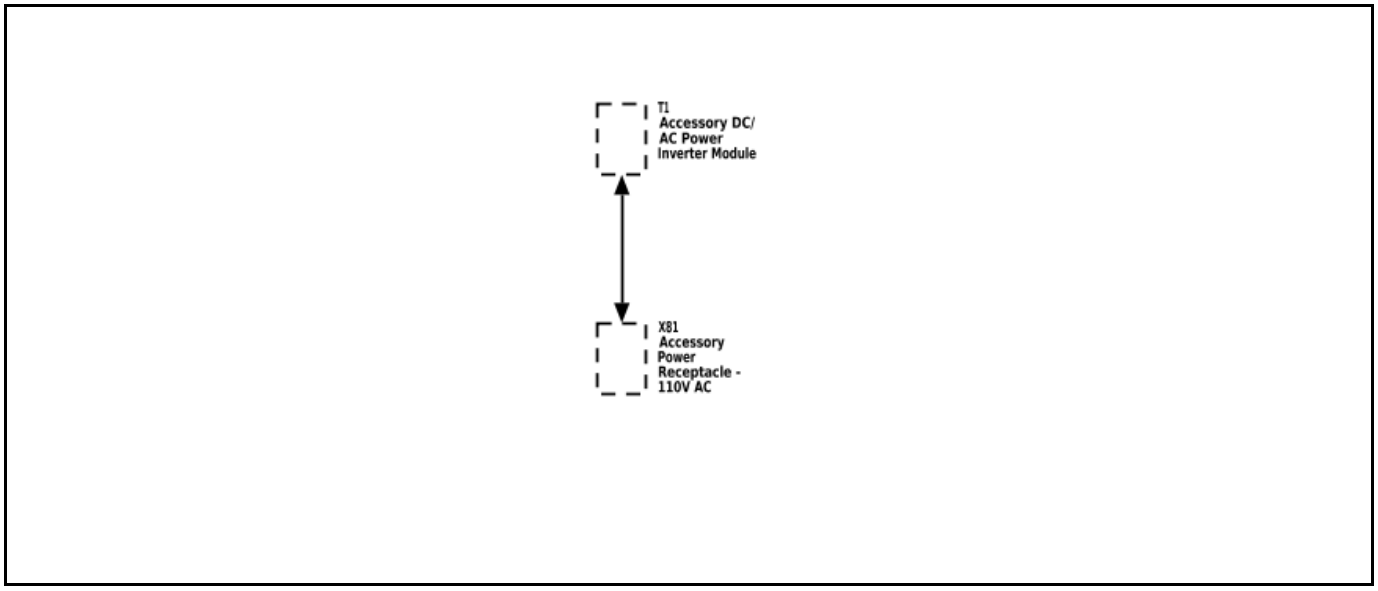
Power Outlets Description and Operation

12 Volt Power Outlet Receptacle Description and Operation

The vehicle is fitted with a 12 V accessory power receptacle. The accessory power receptacles are controlled by an ignition operated relay. The accessory power receptacles are operational when the ignition is turned to either the On or the Accessories positions. The X80J and X80K accessory power receptacles may be configured to be operational when the ignition is Off by changing the position of the 50A fuse from the F10DL position to the F11DL position in the left instrument panel fuse block.

110 Volt Power Outlet Receptacle System Description

Power Outlets Block Diagram



3403851

The alternating current (AC) accessory power outlet system consists of the accessory DC/AC power inverter module and the accessory power receptacle – 110 V AC. The accessory DC/AC power inverter module converts 12 V direct current (DC) battery power to 110 V at 60 Hertz (Hz) AC power to operate AC powered devices. The accessory DC/AC power inverter module provides up to 150 watts of power. The accessory power receptacle – 110 V AC provides the usual connection for AC powered devices.

110 Volt Power Outlet Receptacle System Operation

The accessory DC/AC power inverter module receives fuse protected battery voltage and is connected to the 12 V electrical system ground. The accessory power receptacle – 110 V AC has an internal switch, that detects when an AC powered device is plugged into the outlet. When the ignition is ON, and an AC powered device is plugged into the accessory power receptacle – 110 V AC, the normally open switch in the accessory power receptacle – 110 V AC, closes. When the accessory DC/AC power inverter module detects the voltage from the accessory power receptacle – 110 V AC switch, the inverter module begins to supply 110 V AC to the accessory power receptacle – 110 V AC after a 1.5 s delay. The accessory AC power system is protected against circuit overload and circuit shorts to ground.

110 Volt Power Outlet Receptacle Isolation Fault Protection

The accessory DC/AC power inverter module contains a ground fault circuit interrupter (GFCI). GFCI monitors the 110 V circuit for a short to vehicle chassis ground. If a 110 V AC short to ground is detected, the accessory DC/AC power inverter module will turn OFF. The module remains OFF, until the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 s delay.

110 Volt Power Outlet Receptacle Overload Shutdown

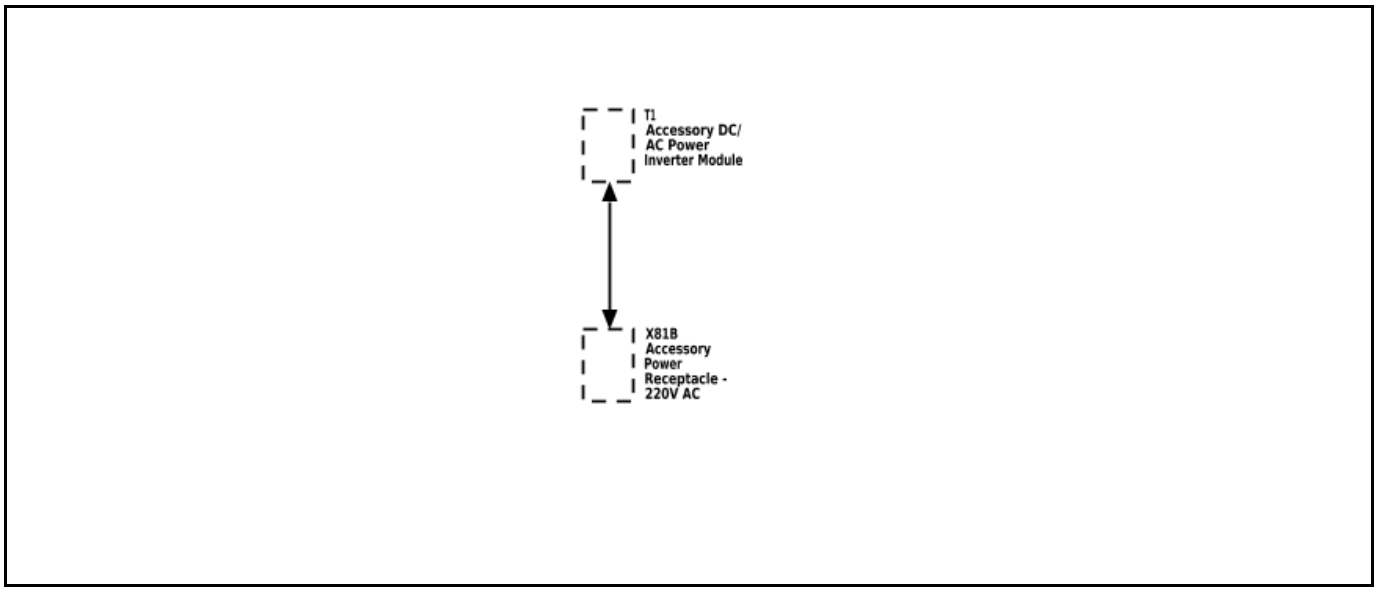
The accessory DC/AC power inverter module will turn OFF if the current in the 110 V circuit is greater than 3.8 A for 1 s , or 2.5 A for 10 s . The module will turn ON again, when the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 s delay.

110 Volt Power Outlet Receptacle Internal Shutdown

The accessory DC/AC power inverter module will turn OFF if the B+ supply voltage is greater than 16.5 V or less than 11 V. The module will also turn OFF if the device temperature is greater than 85°C (185°F). The module will turn ON again, after the shutdown condition is corrected, and the AC powered device is unplugged from the outlet, and then plugged into the outlet.

230 Volt Power Outlet Receptacle System Description

Power Outlets Block Diagram



3403853

The alternating current (AC) accessory power outlet system consists of the accessory DC/AC power inverter module and the accessory power receptacle – 220V AC. The accessory DC/AC power inverter module converts 12 V direct current (DC) battery power to 220–230 V at 50 Hertz (Hz) AC power to operate AC powered devices. The accessory DC/AC power inverter module provides up to 150 watts of power. The accessory power receptacle – 220V AC provides the usual connection for AC powered devices.

230 Volt Power Outlet Receptacle System Operation

The accessory DC/AC power inverter module receives fuse protected battery voltage and is connected to the 12 V electrical system ground. The accessory power receptacle – 220V AC has an internal switch, that detects when an AC powered device is plugged into the outlet. When the ignition is ON, and an AC powered device is plugged into the accessory power receptacle – 220V AC, the normally open switch in the accessory power receptacle – 220V AC, closes. When the accessory DC/AC power inverter module detects the voltage from the accessory power receptacle – 220V AC switch, the inverter module begins to supply 220–230 V AC to the accessory power receptacle – 220V AC after a 1.5 second delay. The accessory AC power system is protected against circuit overload and circuit shorts to ground.

230 Volt Power Outlet Receptacle Isolation Fault Protection

The accessory DC/AC power inverter module contains a ground fault circuit interrupter (GFCI). GFCI monitors the 230 V circuit for a short to vehicle chassis ground. If a 230 V AC short to ground is detected, the accessory DC/AC power inverter module will turn OFF. The module remains OFF, until the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 s delay.

230 Volt Power Outlet Receptacle Overload Shutdown

The accessory AC/DC power control module will turn OFF if the current in the 230 V circuit is greater than 3.8 A for 1 second, or 2.5 A for 10 seconds. The module will turn ON again, when the AC powered device is unplugged from the outlet, and then plugged into the outlet after a 3 second delay.

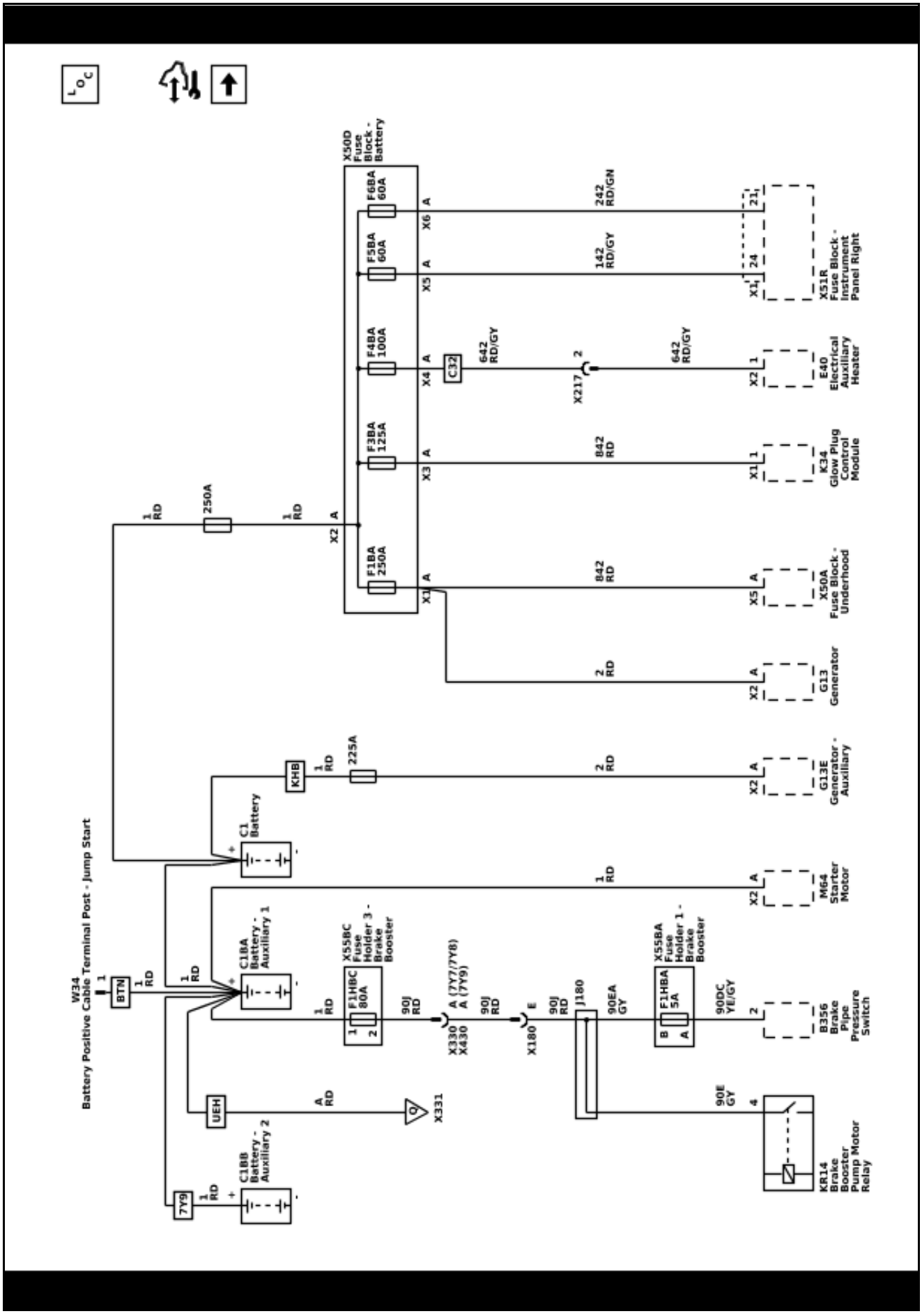
230 Volt Power Outlet Receptacle Internal Shutdown

The accessory DC/AC power inverter module will turn OFF if the B+ supply voltage is greater than 16.5 V or less than 11 V. The module will also turn OFF if the device temperature is greater than 85°C (185°F). The module will turn ON again, after the shutdown condition is corrected, and the AC powered device is unplugged from the accessory power receptacle – 220V AC, and then plugged into the accessory power receptacle – 220V AC.

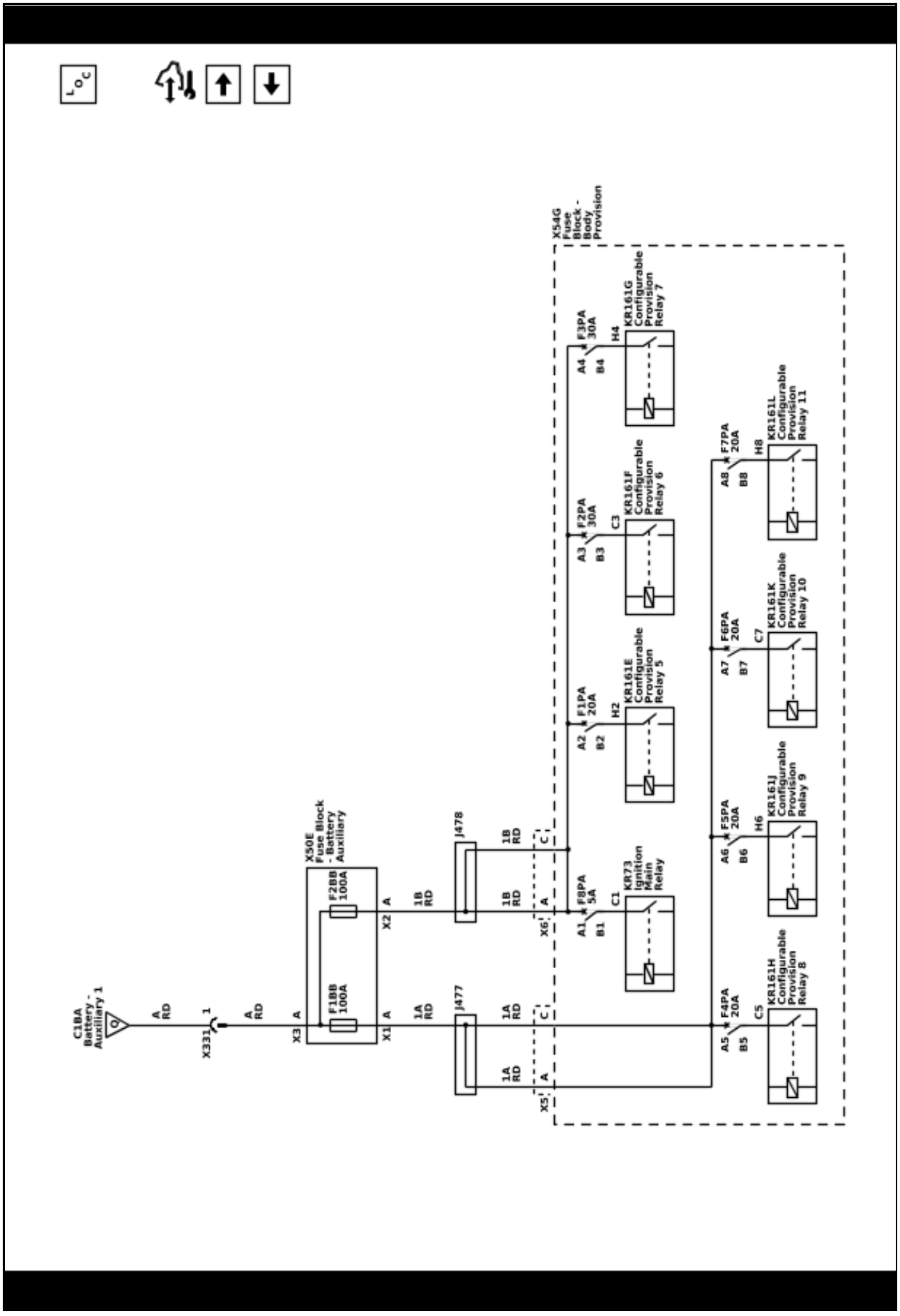
Wiring Systems and Power Management

Schematic and Routing Diagrams

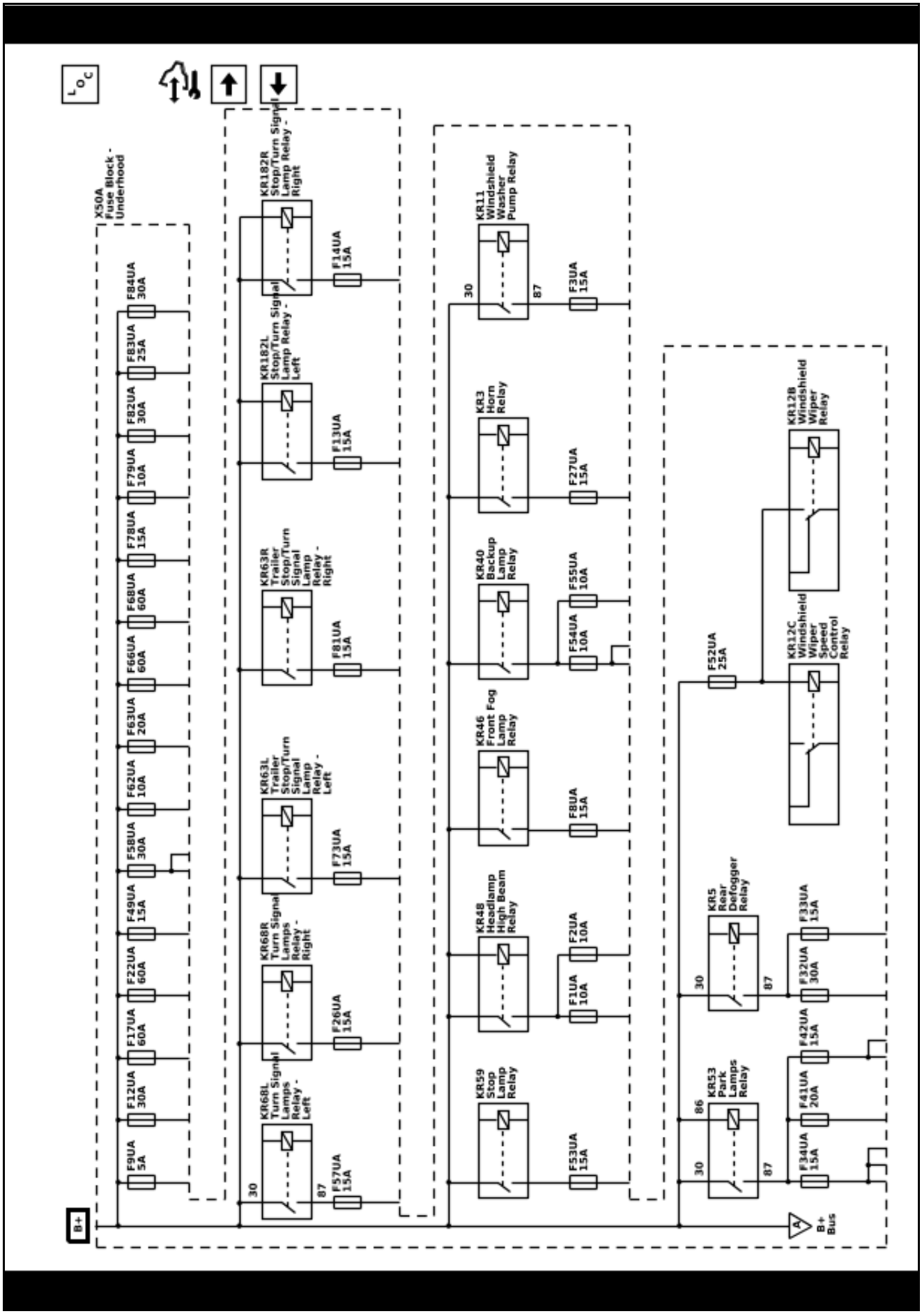
Power Distribution Schematics (X50D Fuse Block - Battery)



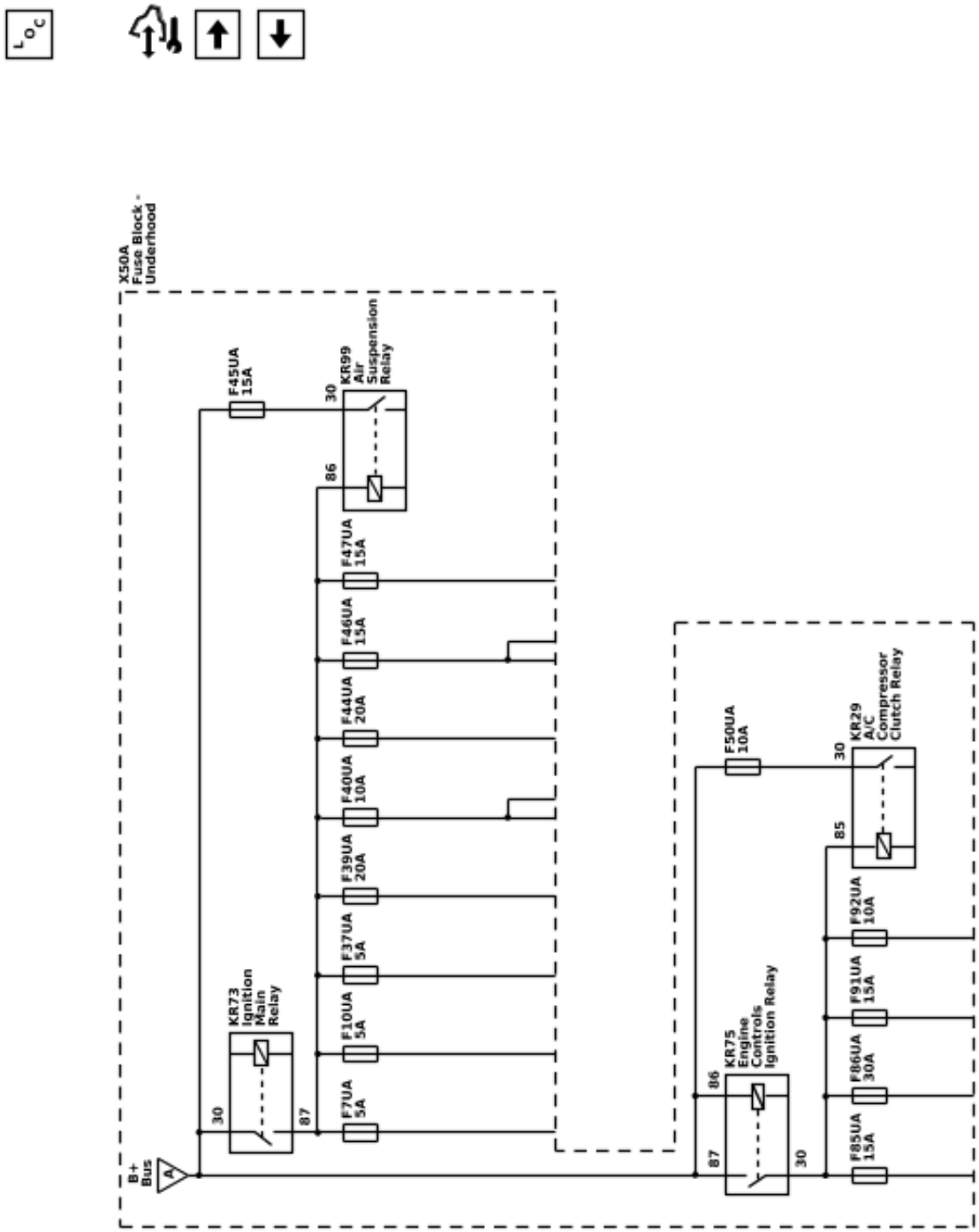
Power Distribution Schematics (B+ Bus X50E Fuse Block - Battery Auxiliary and X54G Fuse Block - Body Provision (UEH))



Power Distribution Schematics (B+ Bus X50A Fuse Block - Underhood 1 of 2)

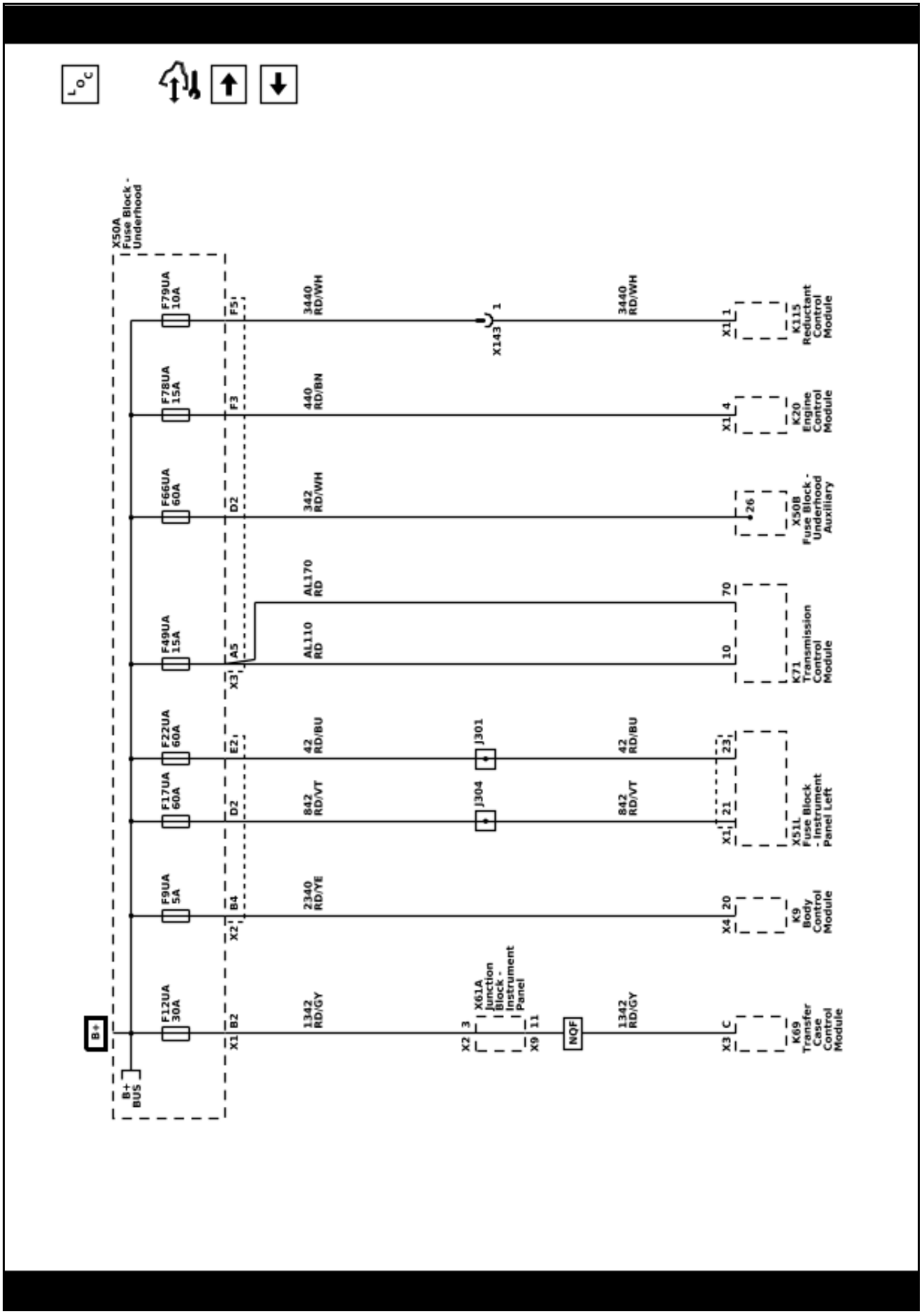


Power Distribution Schematics (B+ Bus X50A Fuse Block - Underhood 2 of 2)

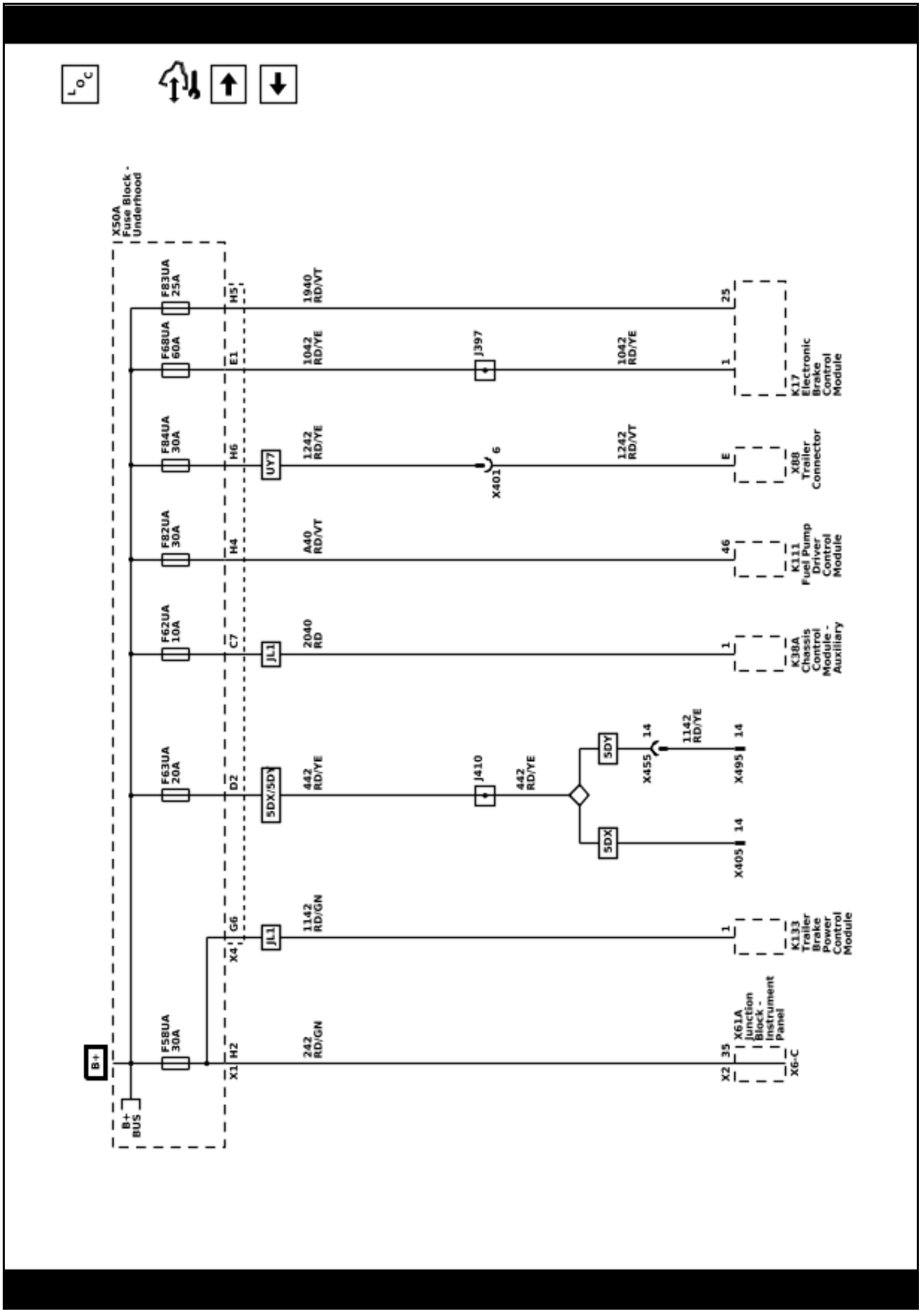


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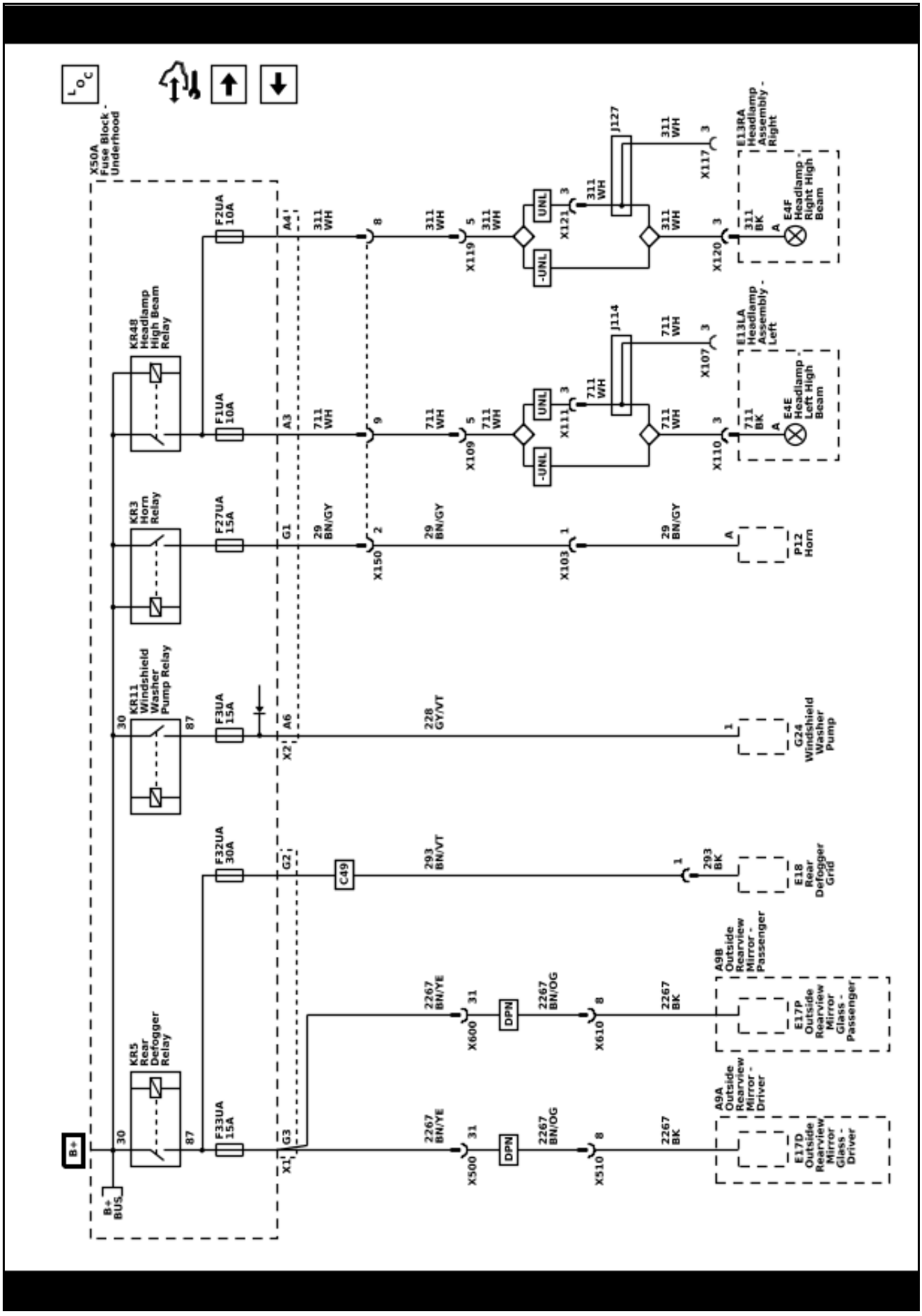
Power Distribution Schematics (F9UA, F12UA, F17UA, F22UA, F49UA, F66UA, F78UA, and F79UA Fuses)



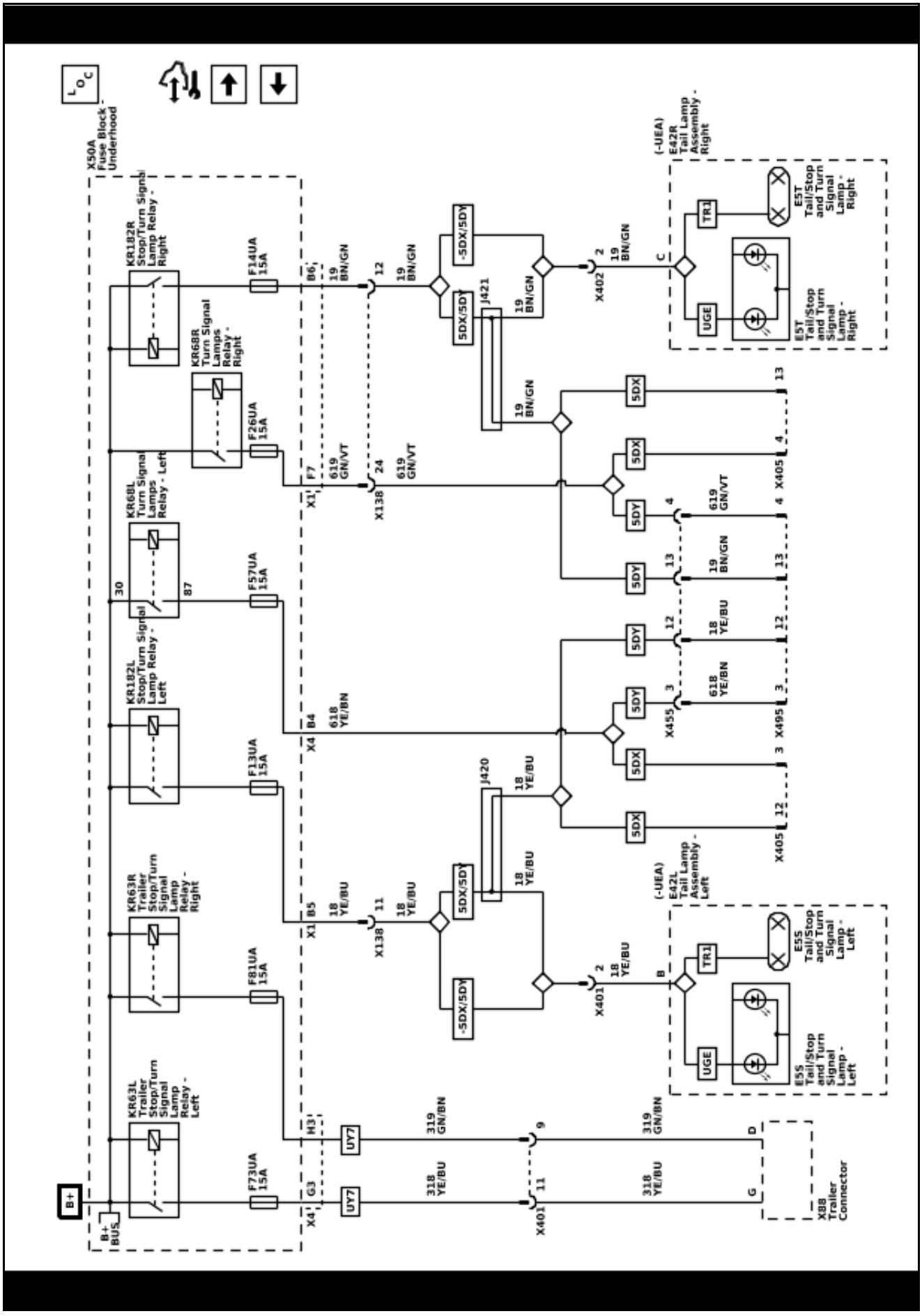
Power Distribution Schematics (F58UA, F62UA, F63UA, F68UA, F82UA F83UA and F84UA Fuses)



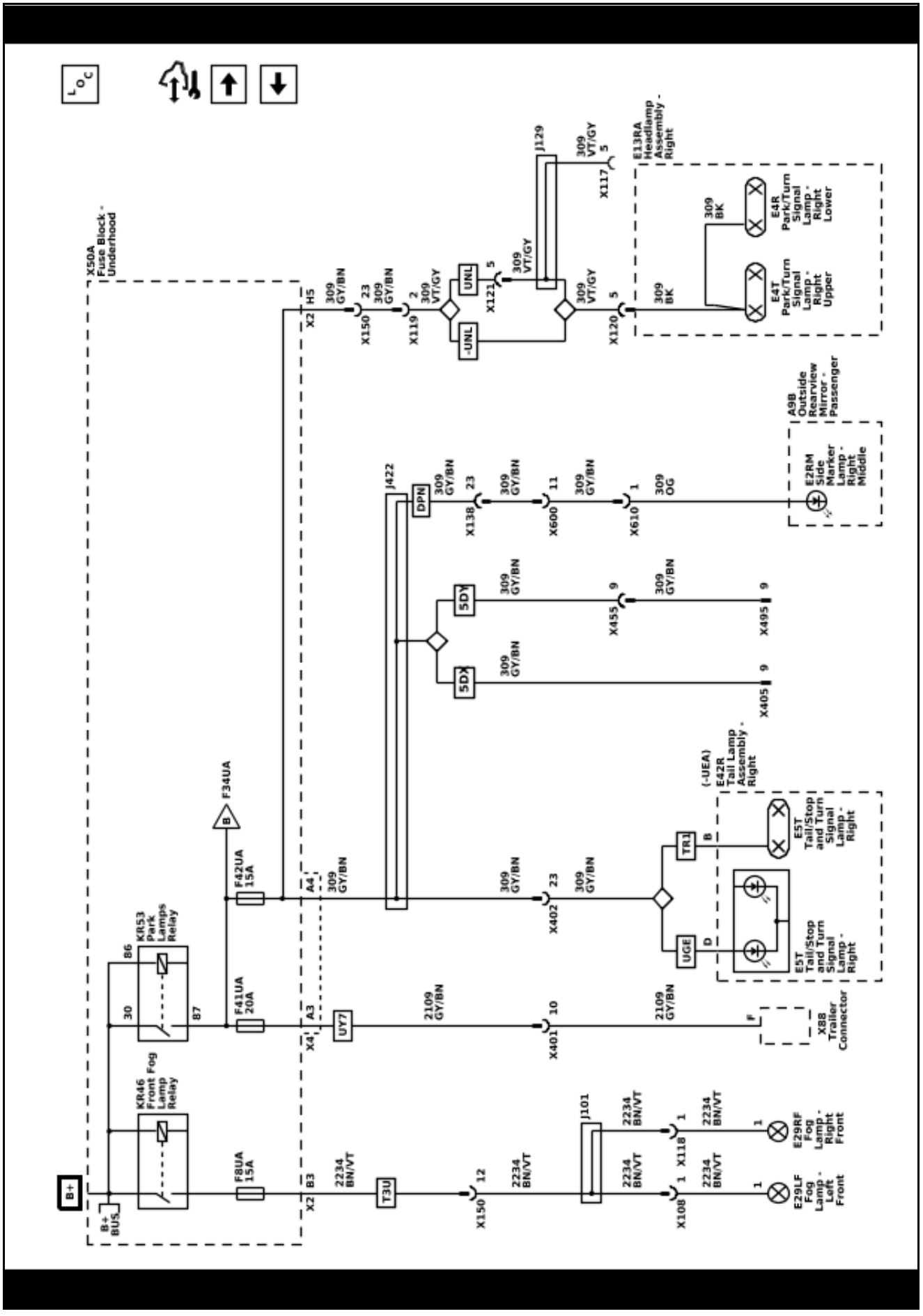
Power Distribution Schematics (F1UA, F2UA, F3UA, F27UA, F32UA and F33UA Fuses)



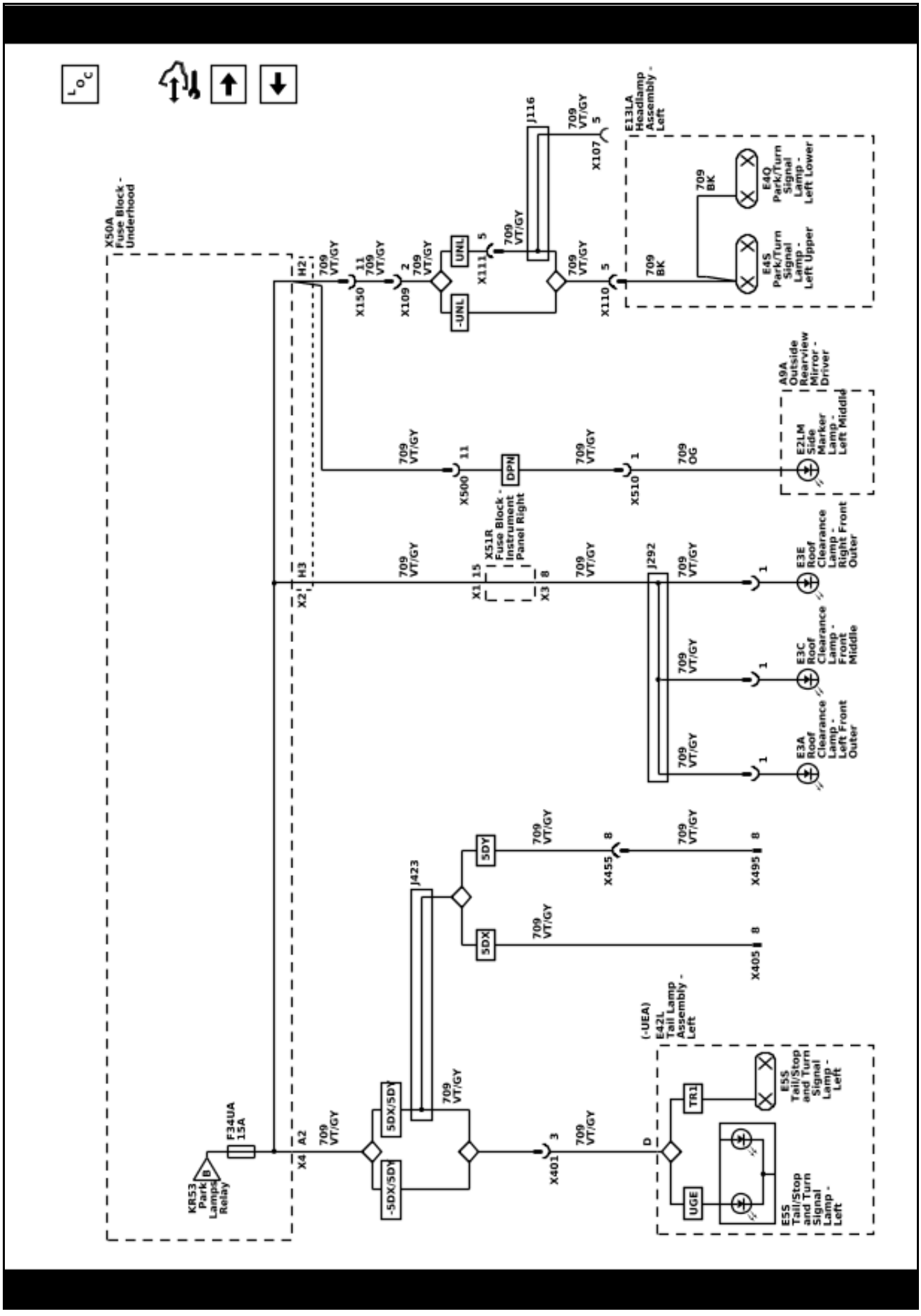
Power Distribution Schematics (F13UA, F14UA, F26UA, F57UA, F73UA and F81UA Fuses)



Power Distribution Schematics (F8UA, F41UA and F42UA Fuses)

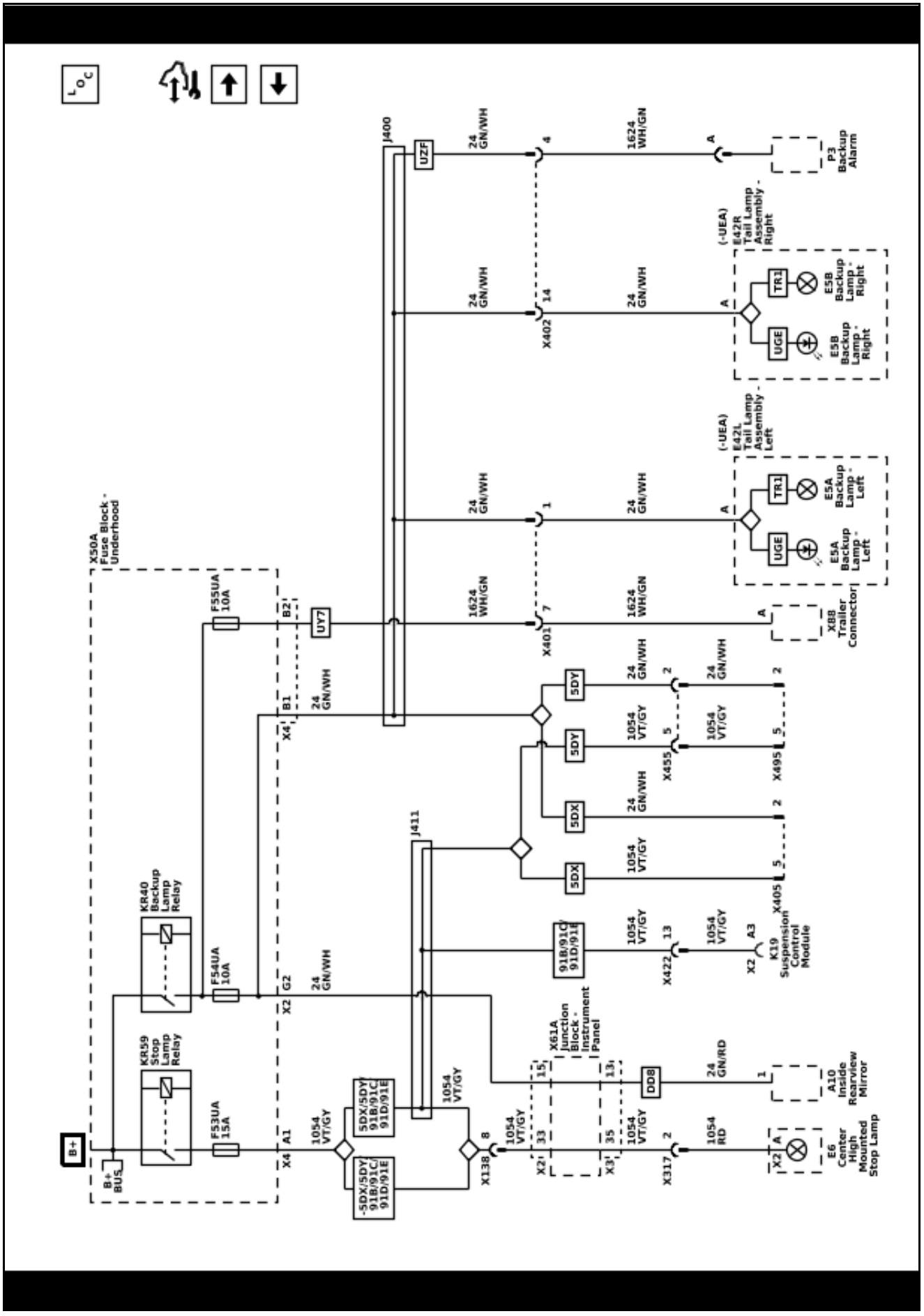


Power Distribution Schematics (F34UA Fuse)

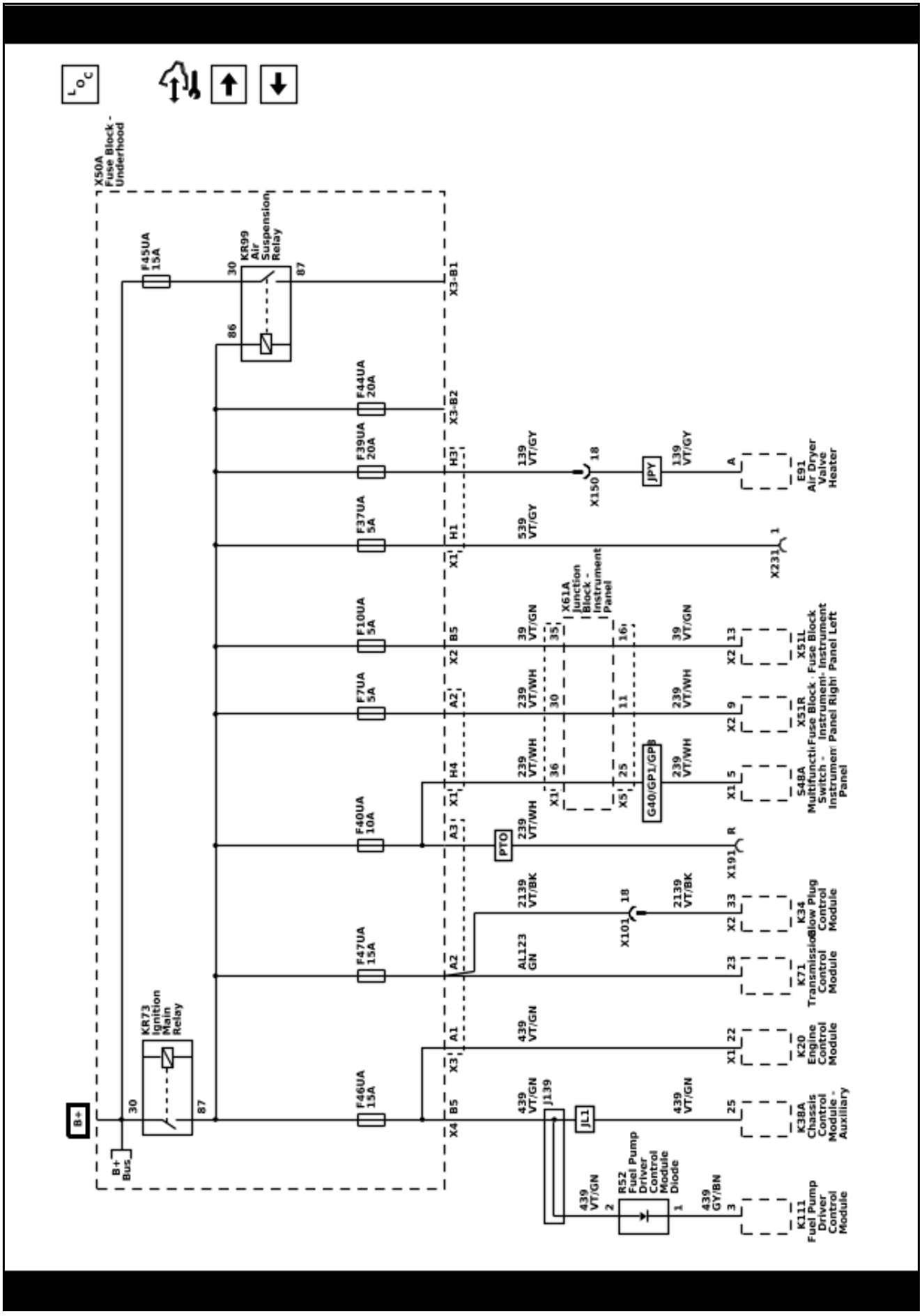


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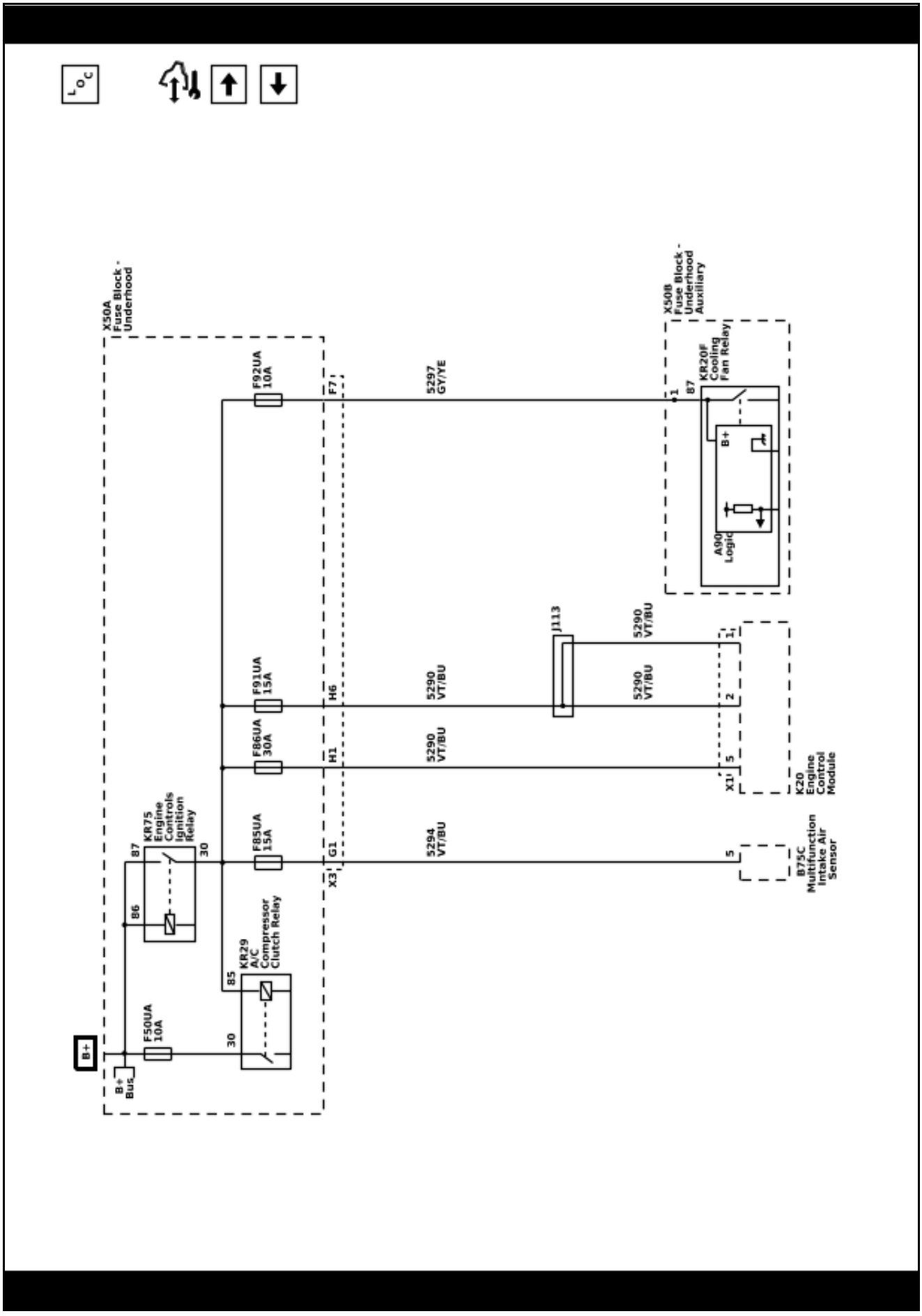
Power Distribution Schematics (F53UA, F54UA and F55UA Fuses)



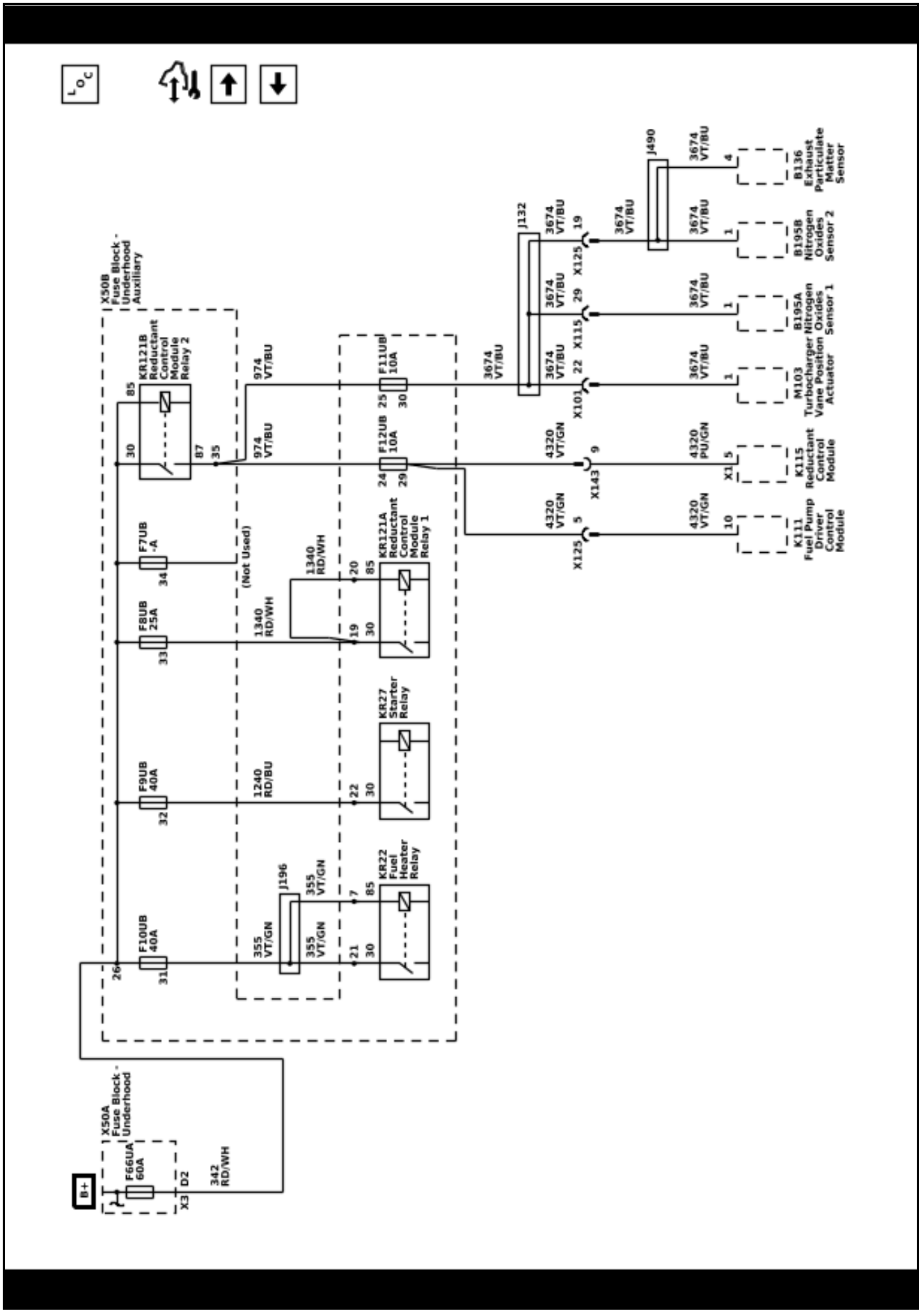
Power Distribution Schematics (F7UA, F10UA, F37UA, F39UA, F40UA, F44UA, F45UA, F46UA and F47UA Fuses)



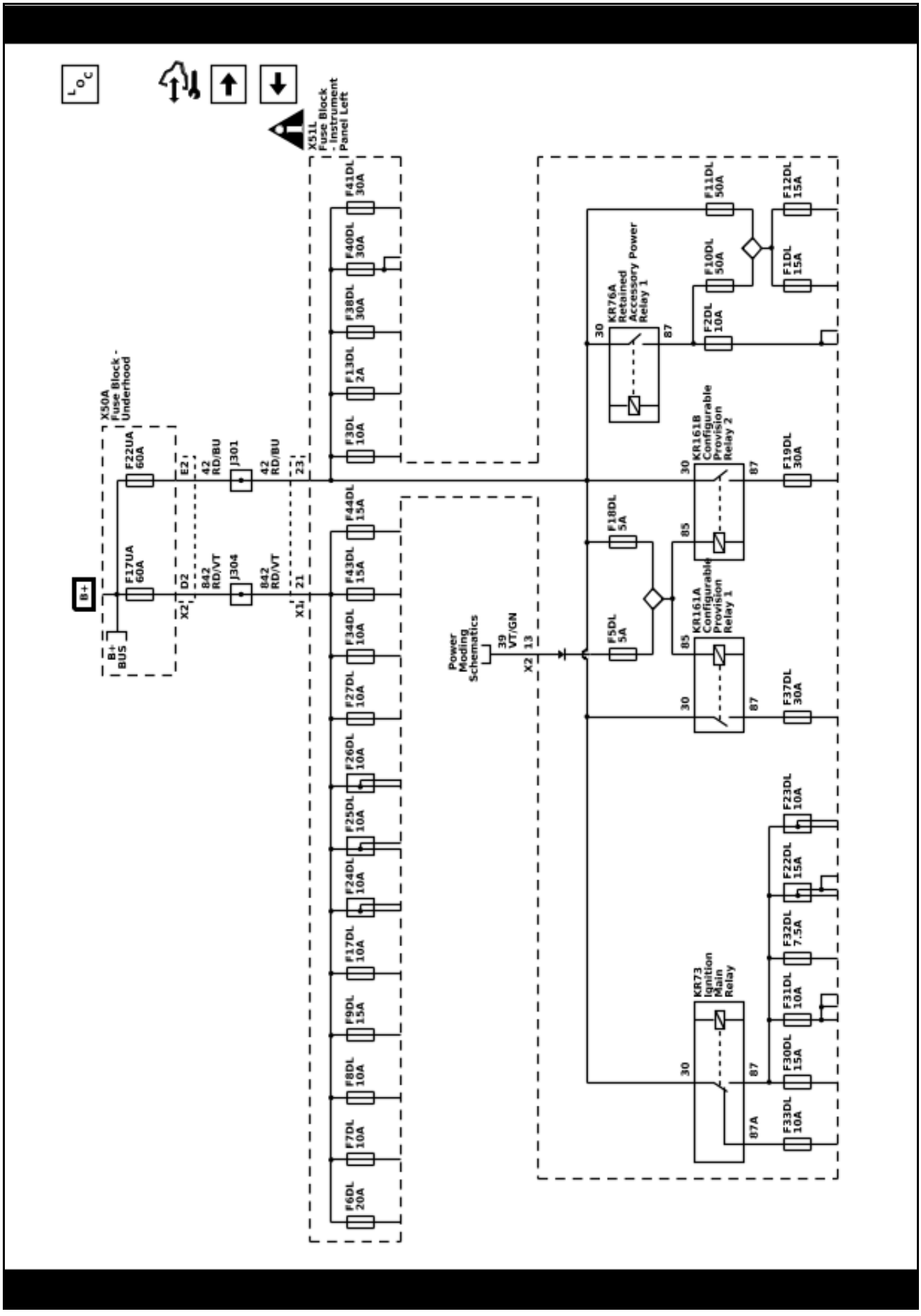
Power Distribution Schematics (F85UA, F86UA, F91UA and F92UA Fuses)



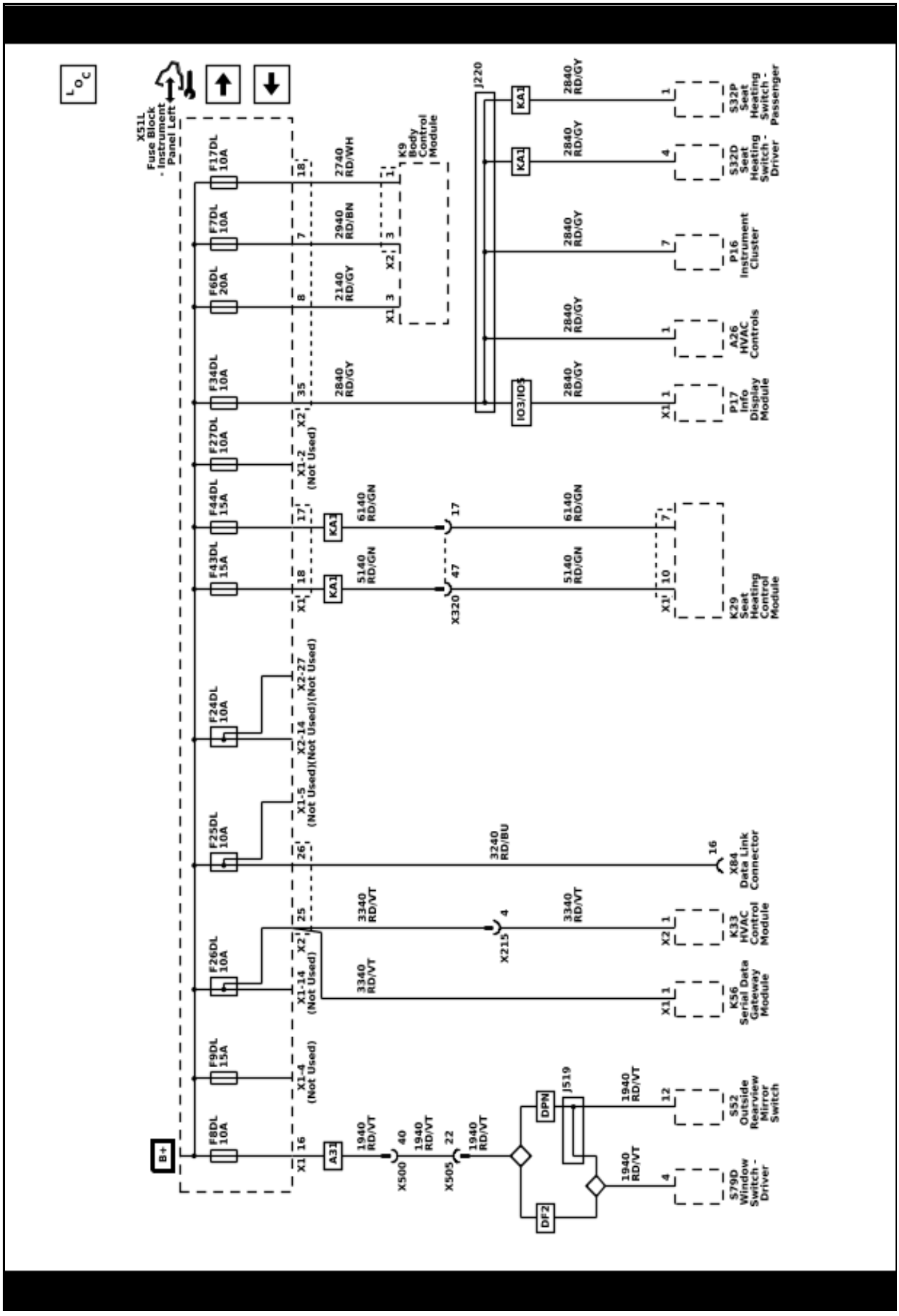
Power Distribution Schematics (F7UB, F8UB, F9UB, F10UB, F11UB and F12UB Fuses)



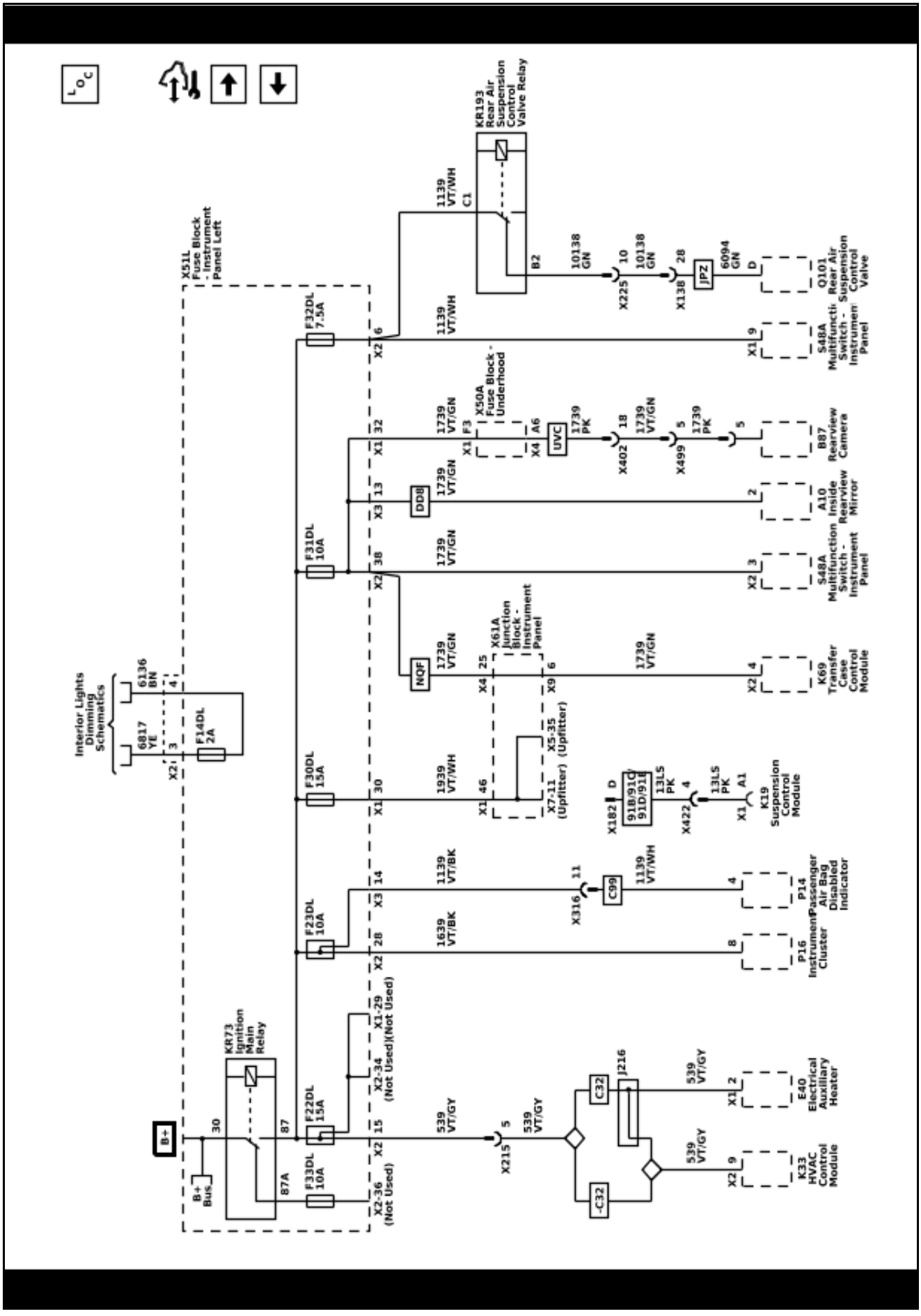
Power Distribution Schematics (B+ Bus X51L Fuse Block - Instrument Panel Left)



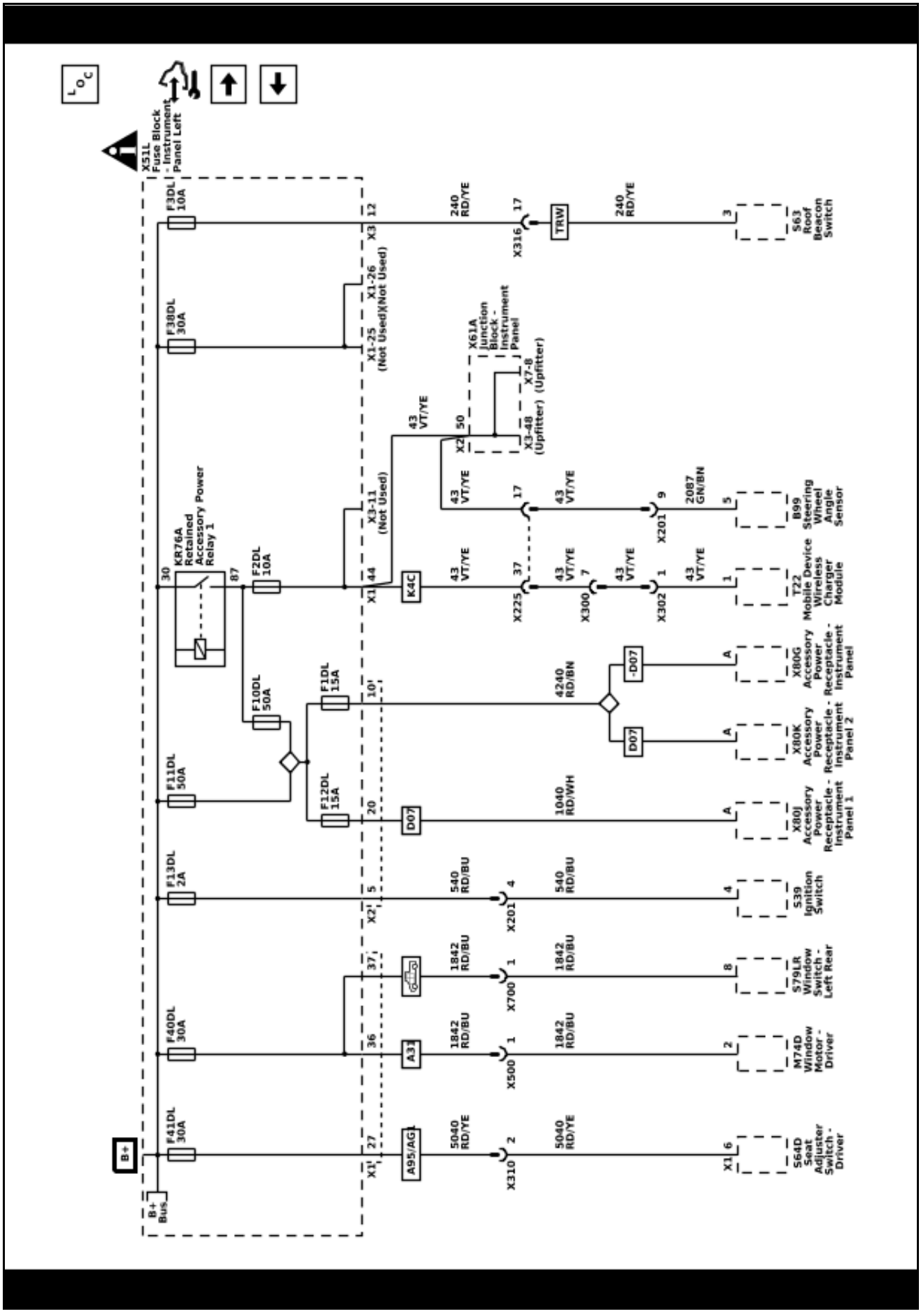
Power Distribution Schematics (F6DL, F7DL, F8DL, F9DL, F17DL, F24DL, F25DL, F26DL, F34DL, F43DL and F44DL Fuses)



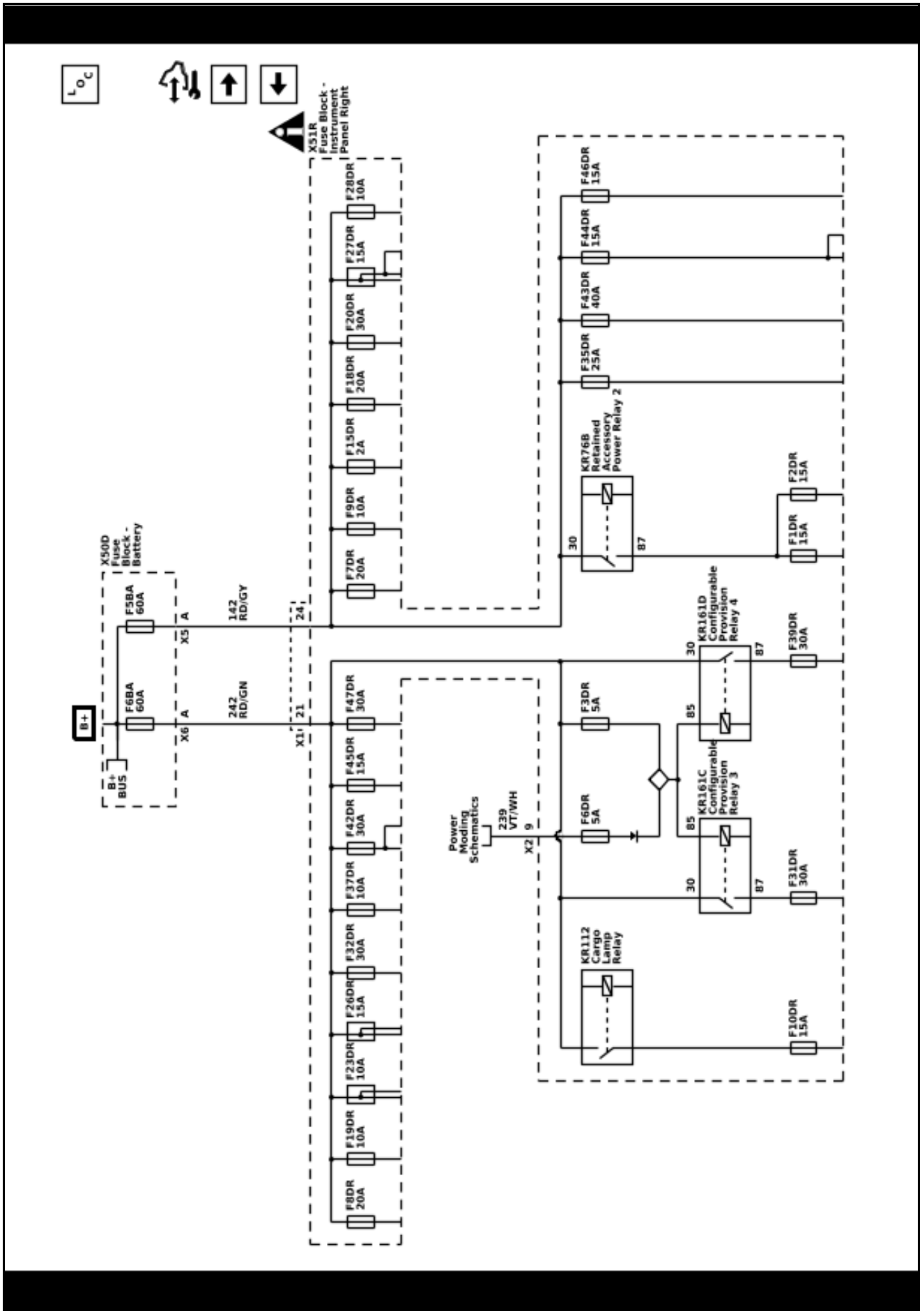
Power Distribution Schematics (F14DL, F22DL, F23DL, F30DL, F31DL, F32DL and F33DL Fuses)



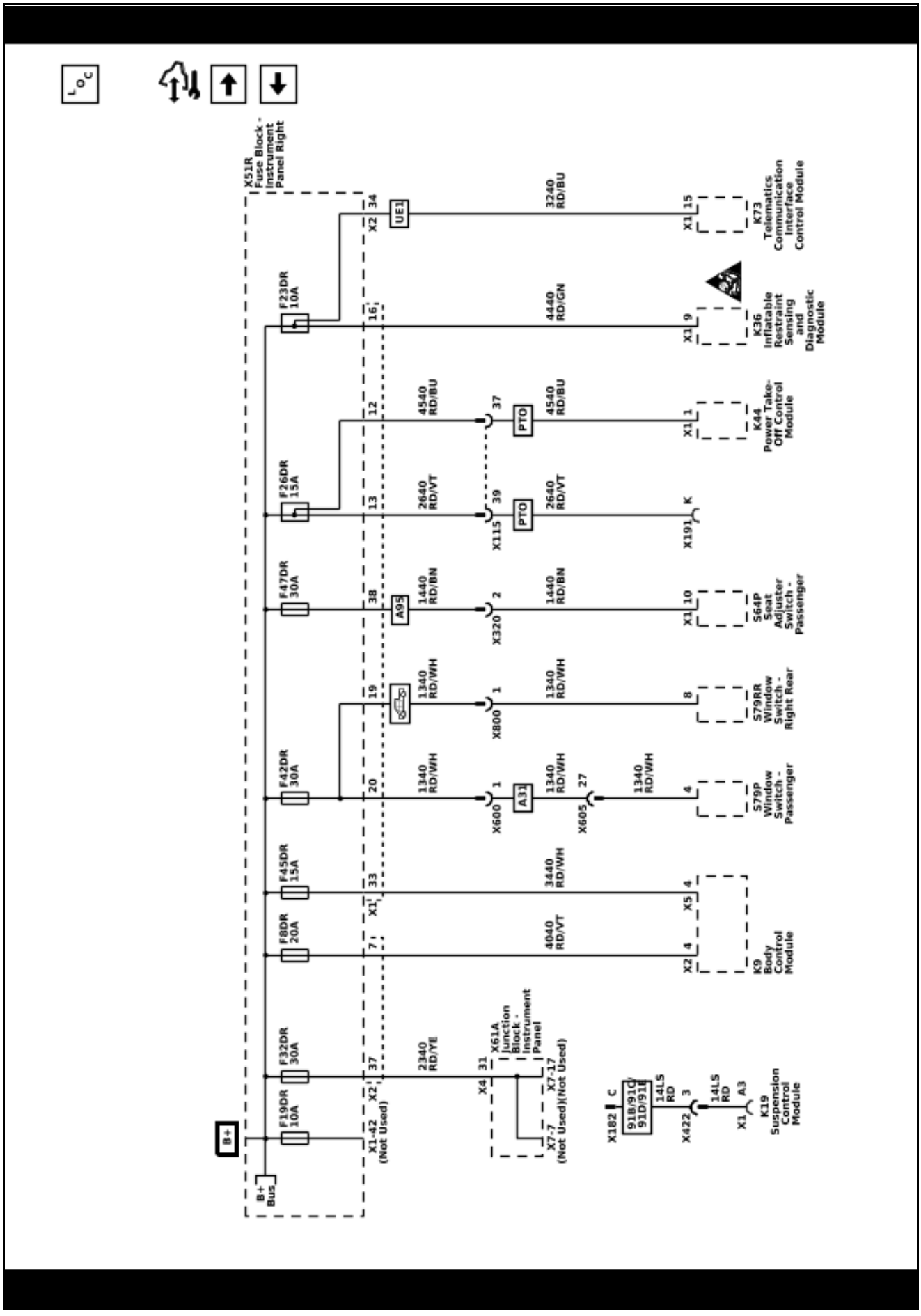
Power Distribution Schematics (F1DL, F2DL, F3DL, F10DL, F11DL, F12DL, F13DL, F38DL, F40DL and F41DL Fuses)



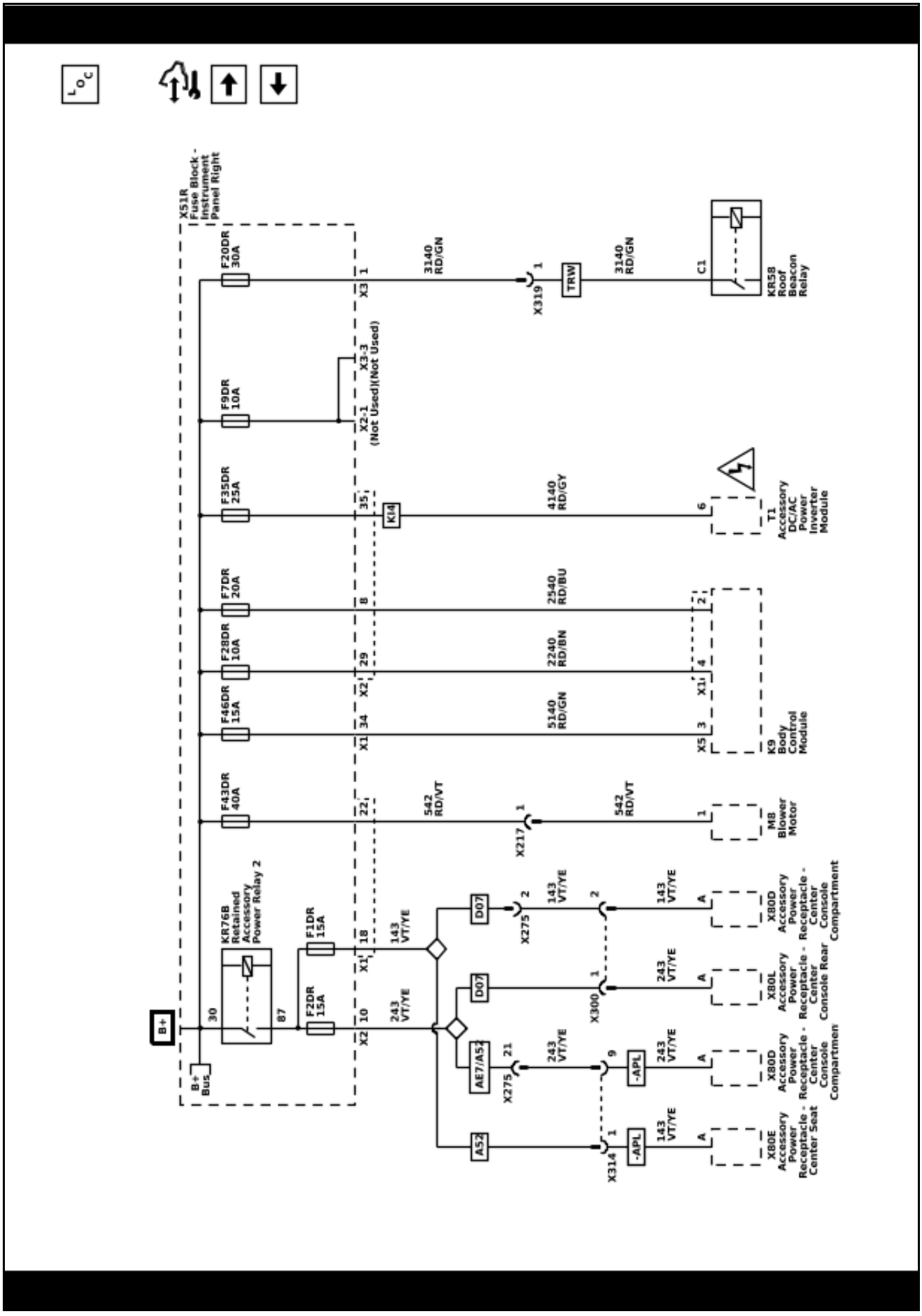
Power Distribution Schematics (B+ Bus X51R Fuse Block - Instrument Panel Right)



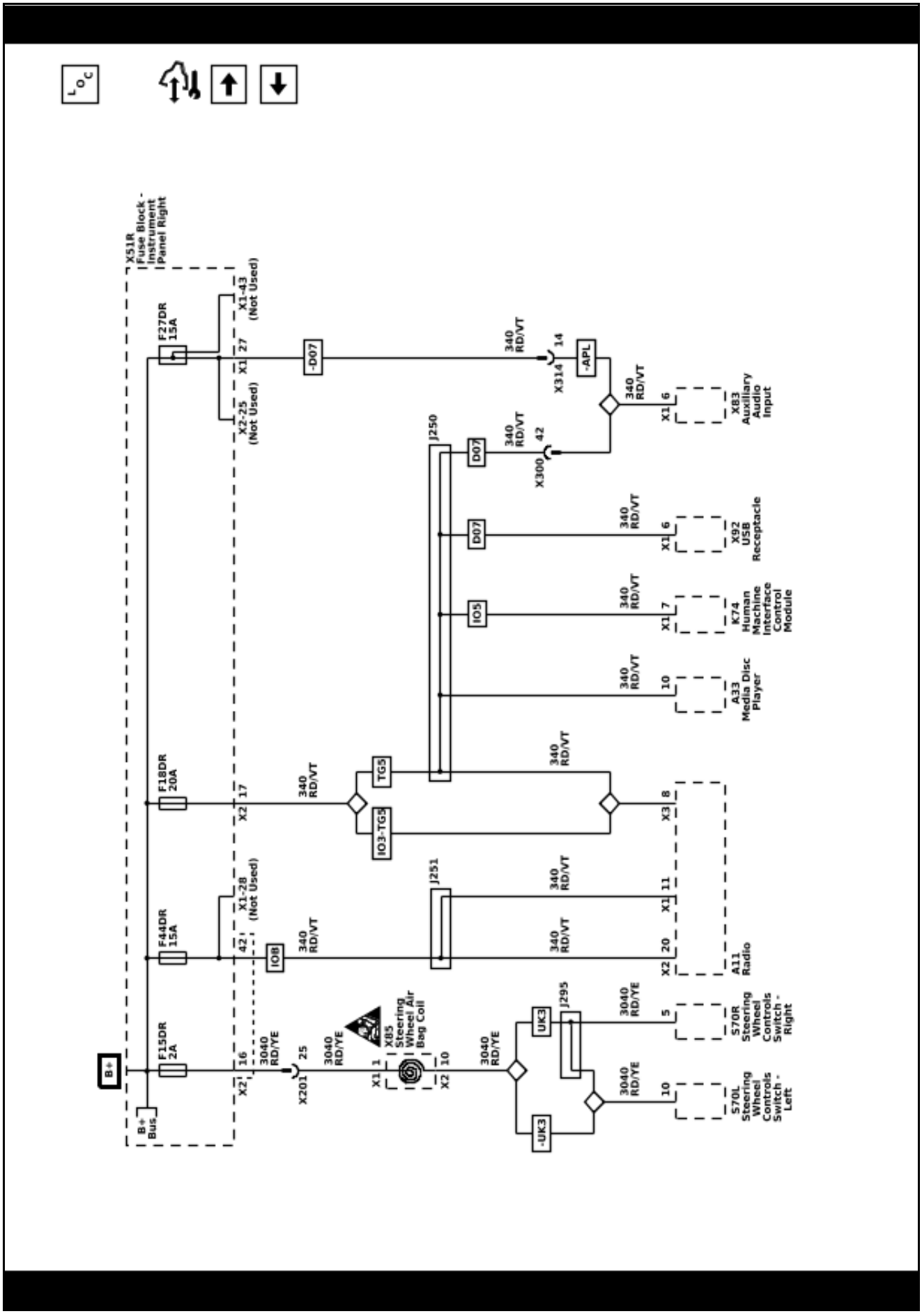
Power Distribution Schematics (F8DR, F23DR, F26DR, F32DR, F42DR, F45DR and F47DR Fuses)



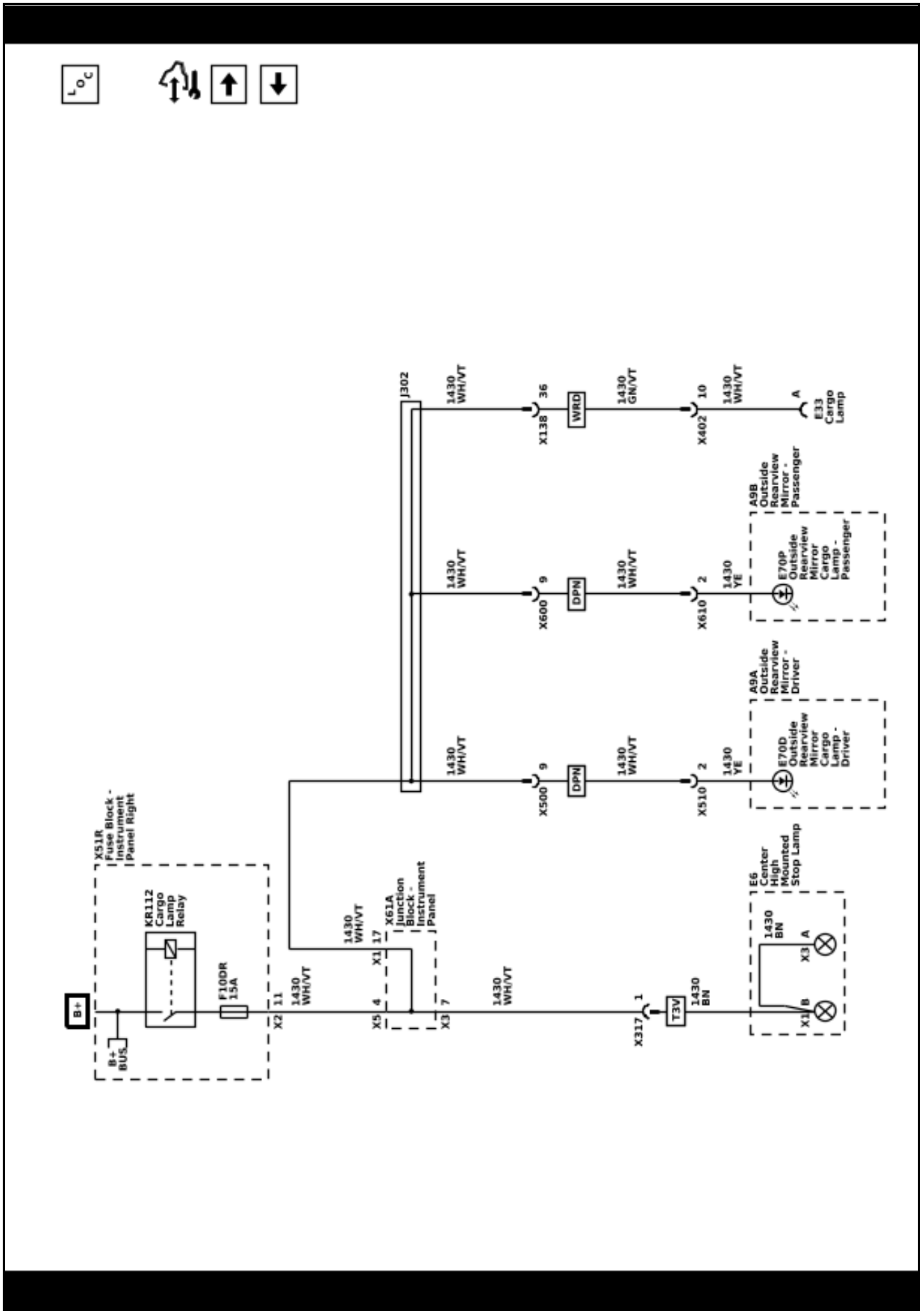
Power Distribution Schematics (F1DR, F2DR, F7DR, F9DR, F20DR, F28DR, F35DR, F43DR, F44DR and F46DR Fuses)



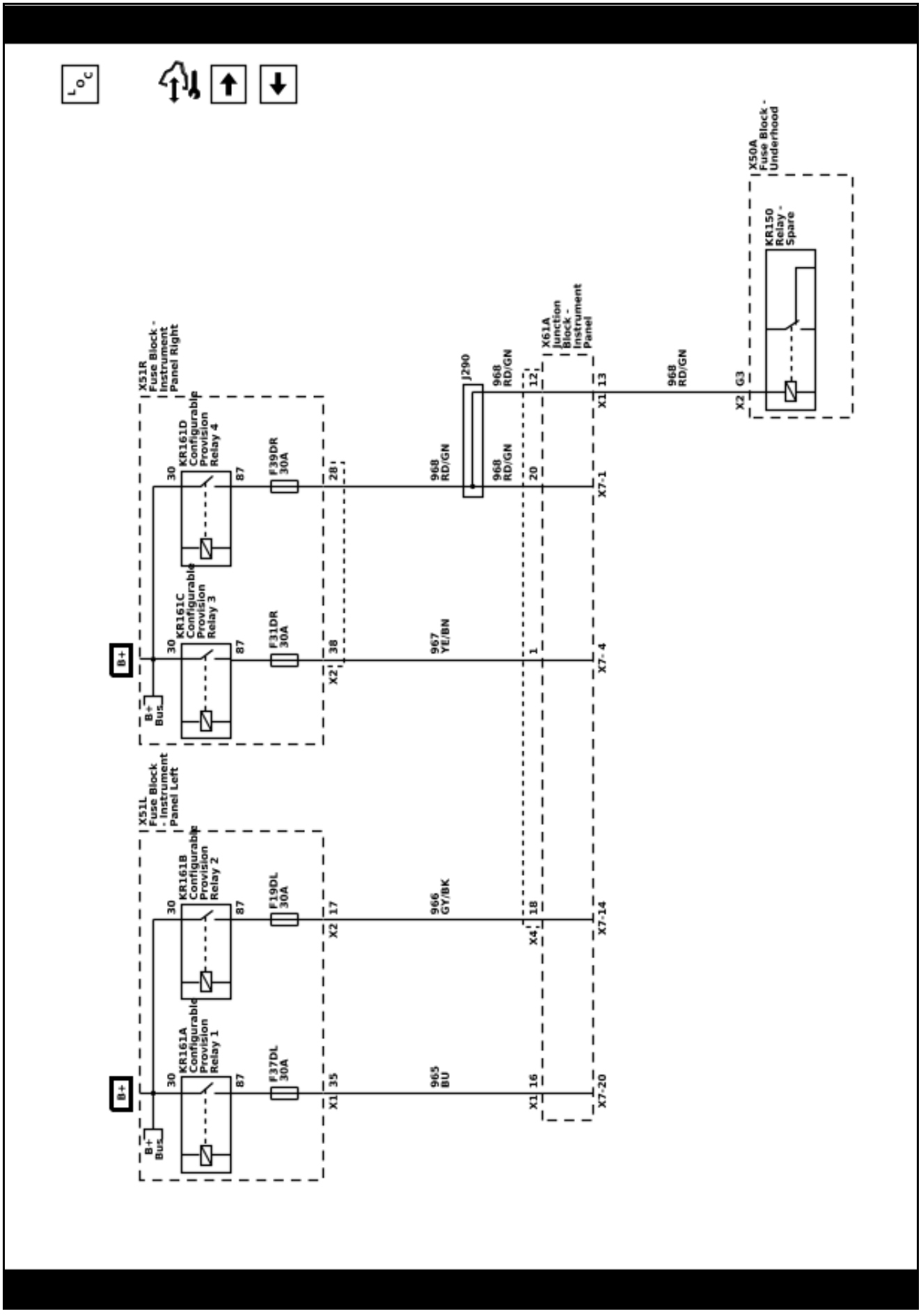
Power Distribution Schematics (F15DR, F18DR, F27DR and F44DR Fuses)



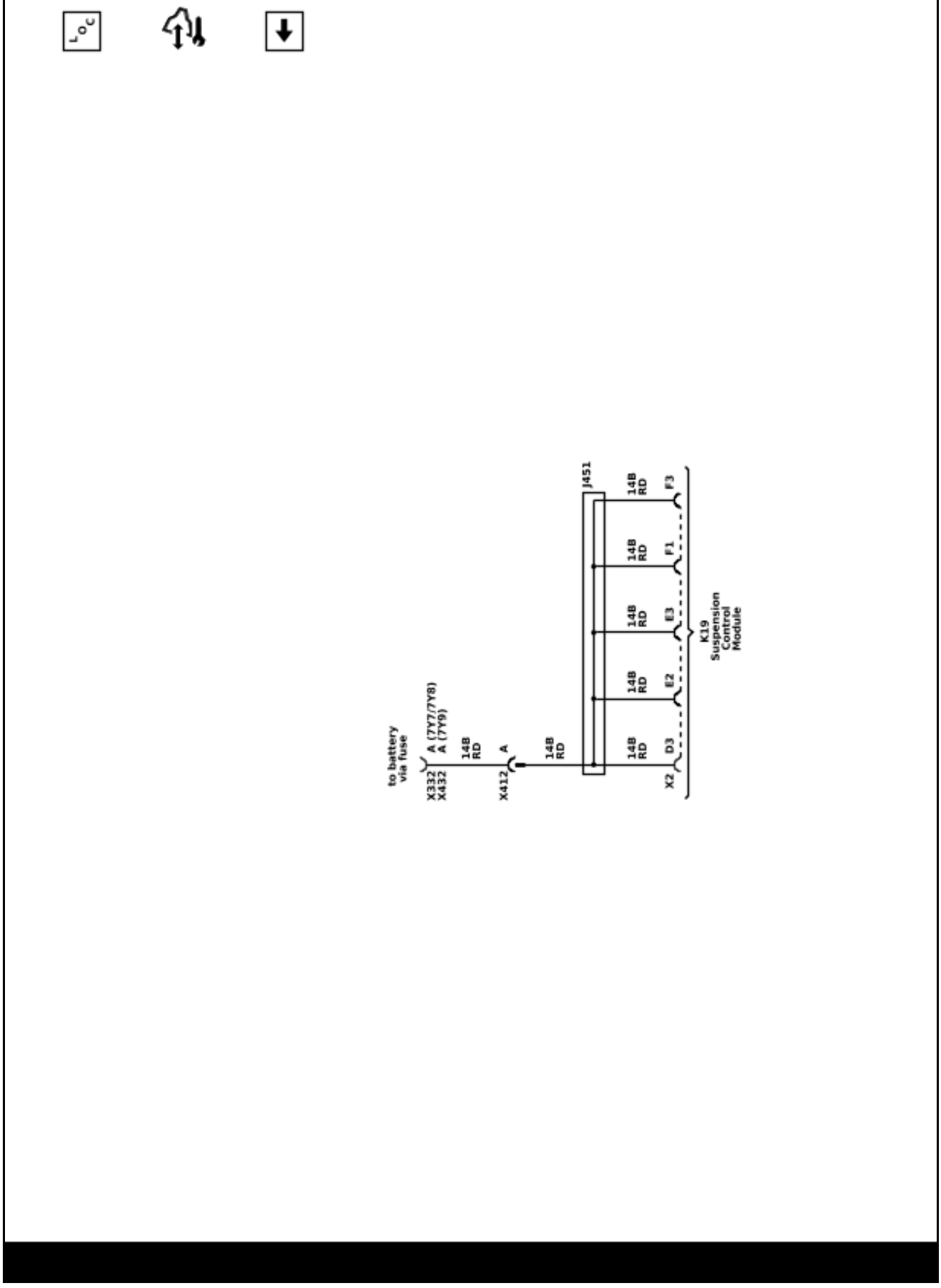
Power Distribution Schematics (F10DR Fuse)



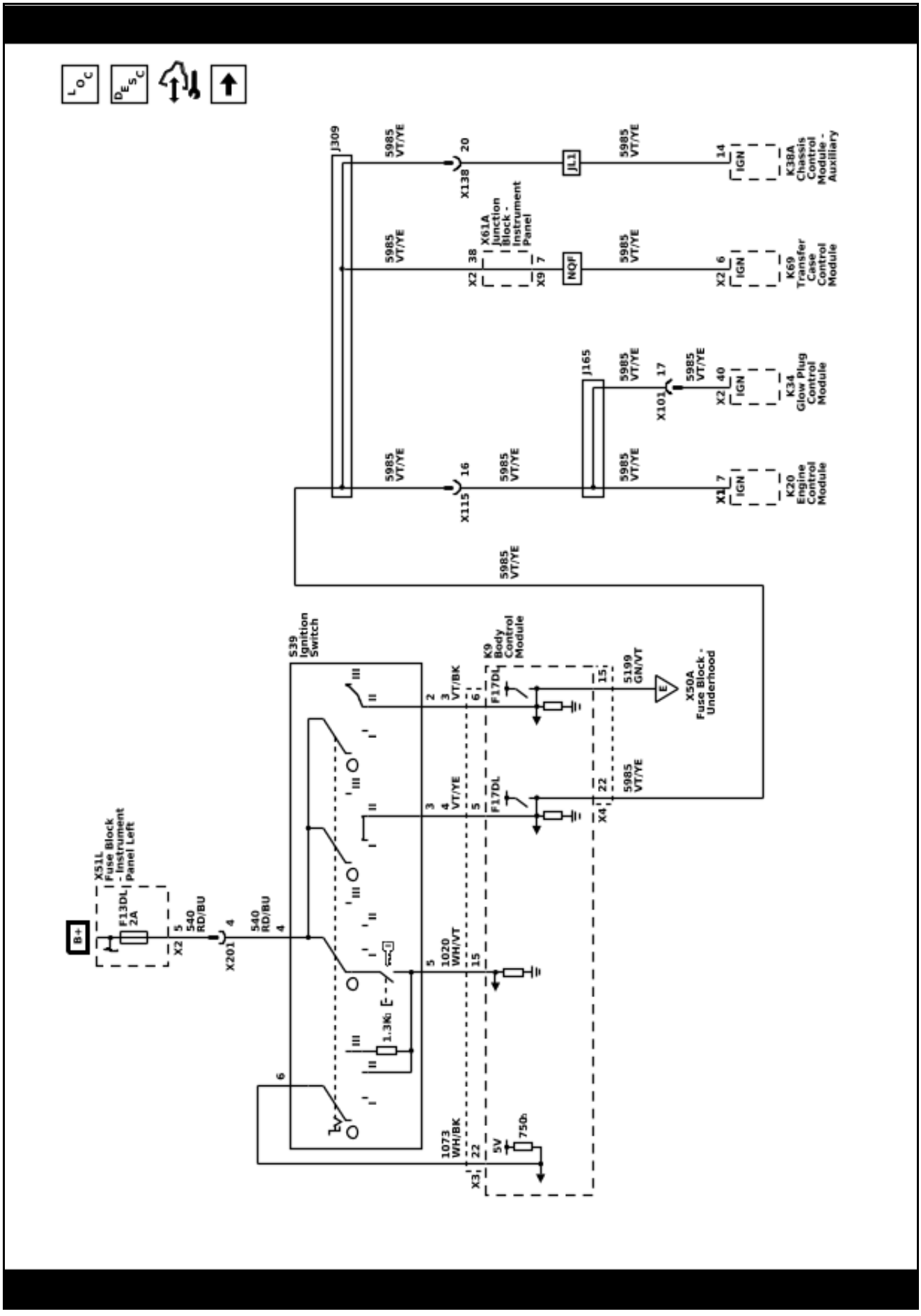
Power Distribution Schematics (F19DL, F31DR, F37DL and F39DR Fuses)



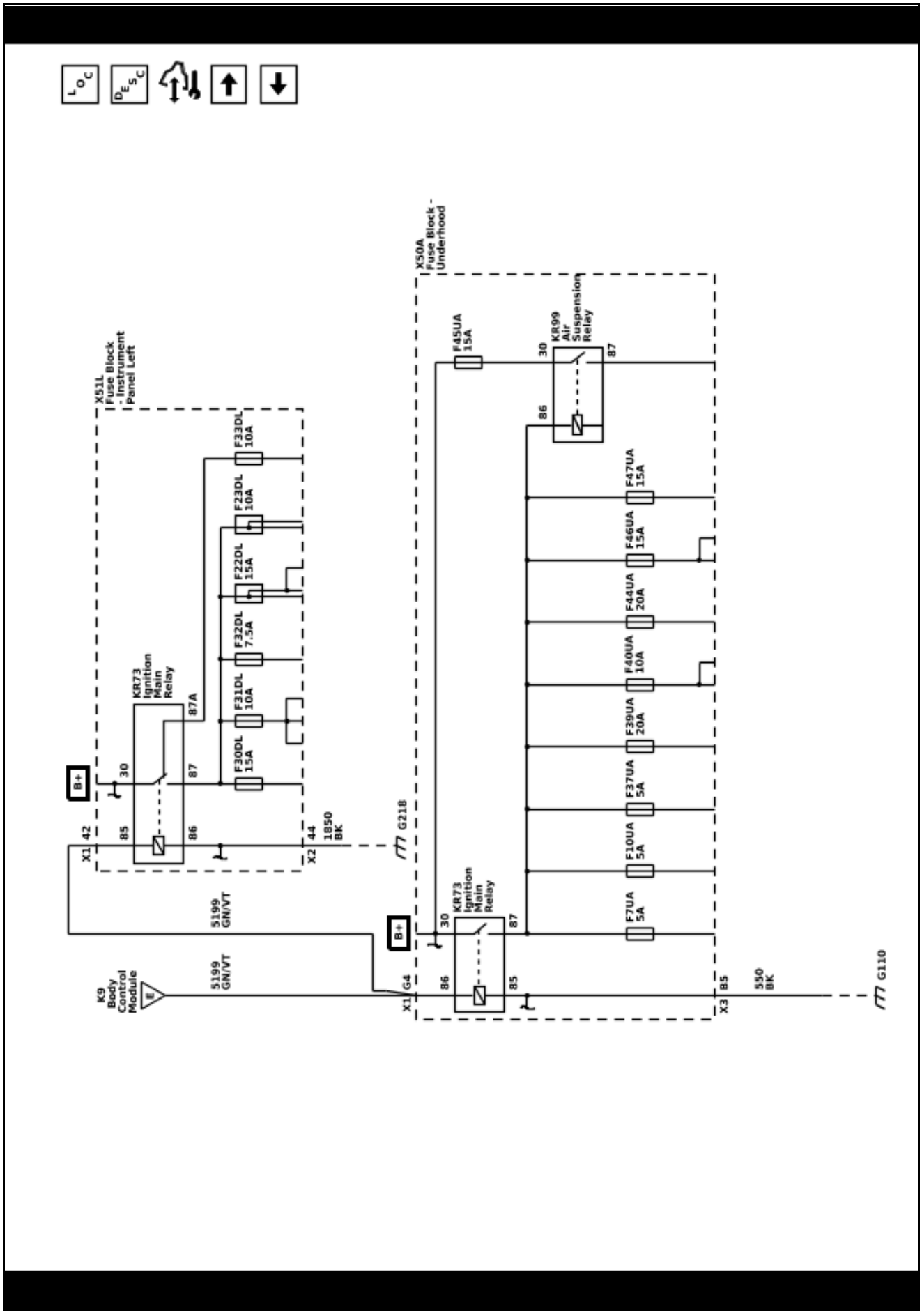
Power Distribution Schematics (B+ feed - K19 Suspension Control Module (91B/91C/91D/91E))



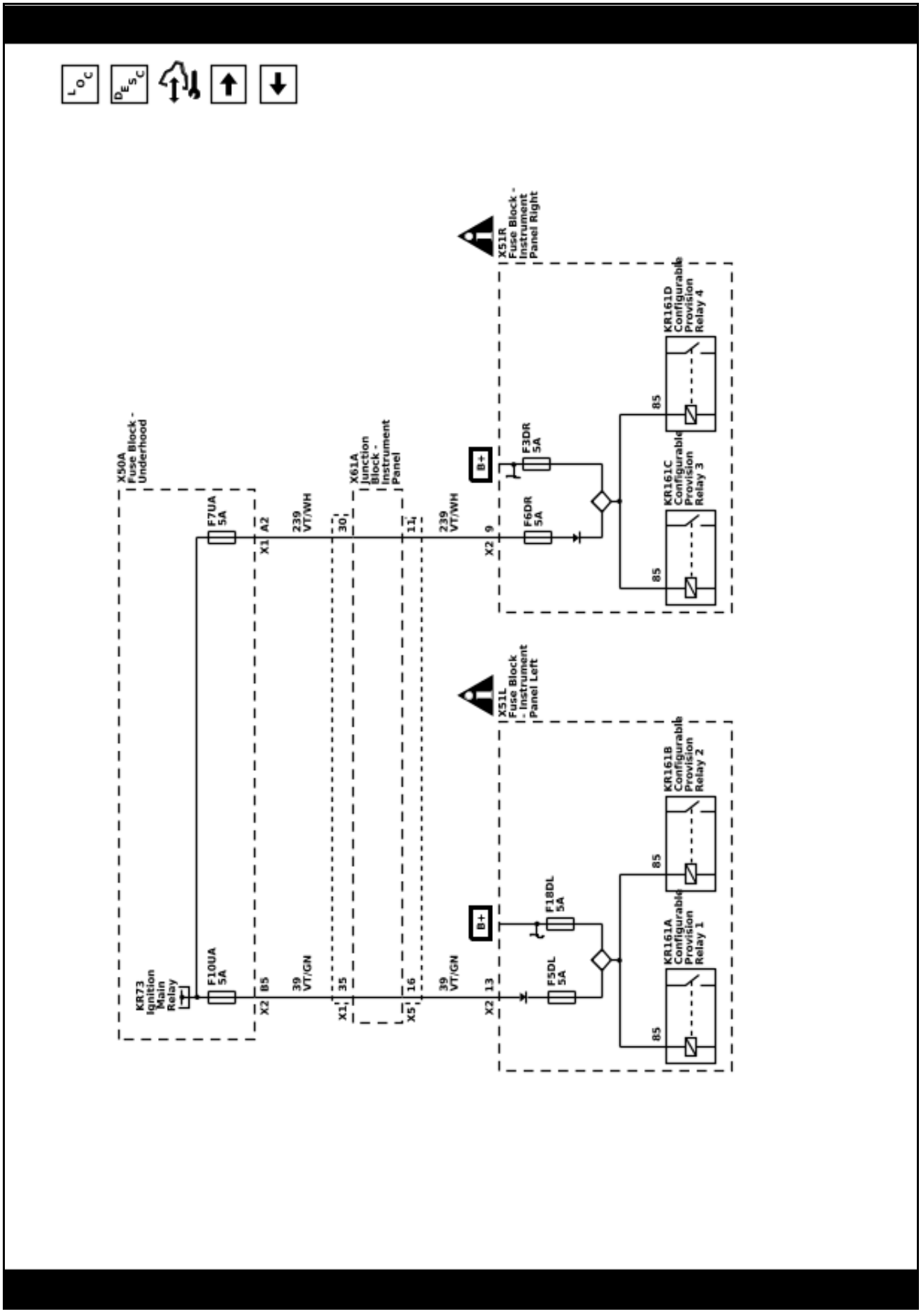
Power Moding Schematics (Ignition Switch and Ignition Power)



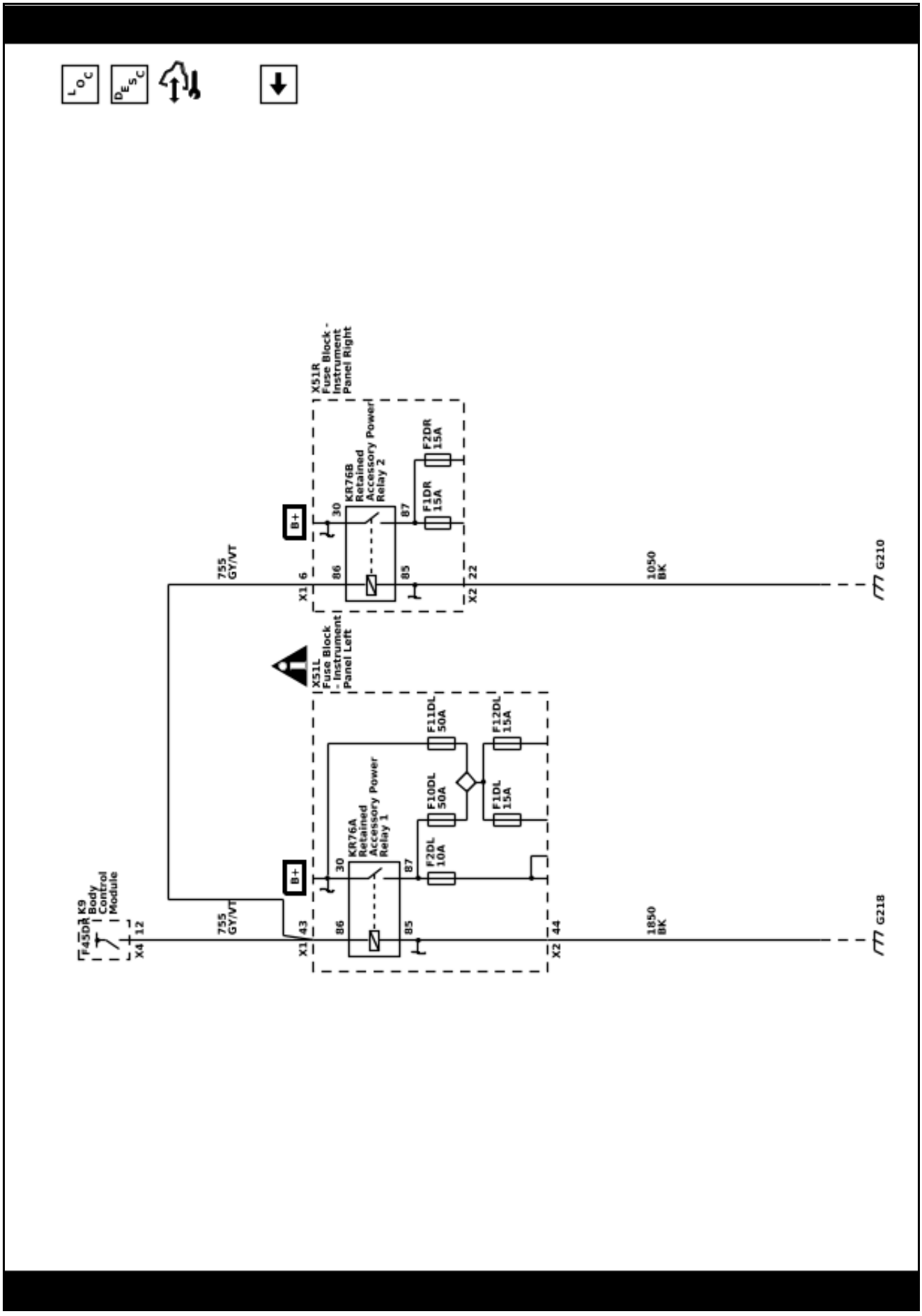
Power Moding Schematics (Ignition Main Relays)



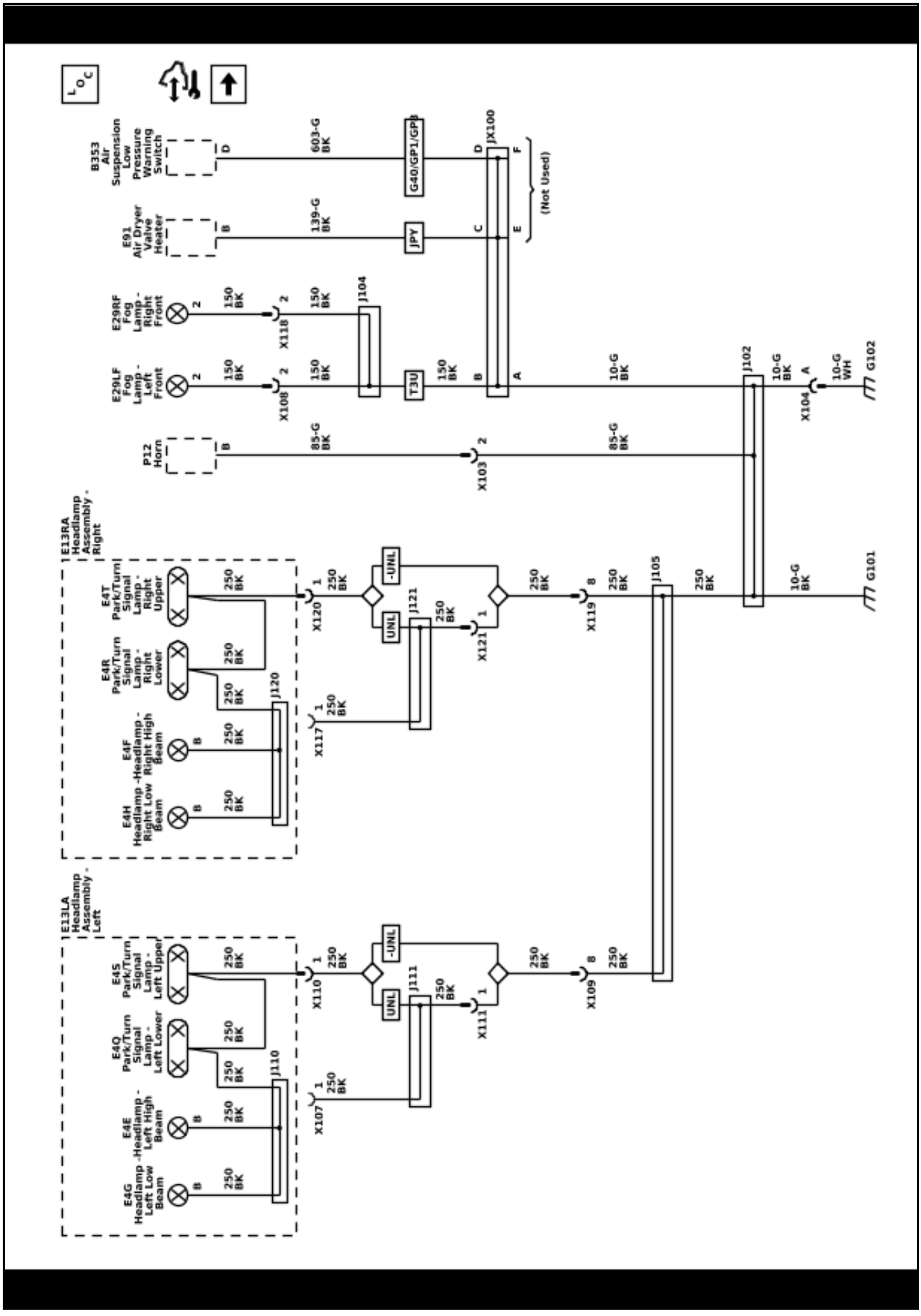
Power Moding Schematics (Ignition Power to Provisional Relays (9L7))



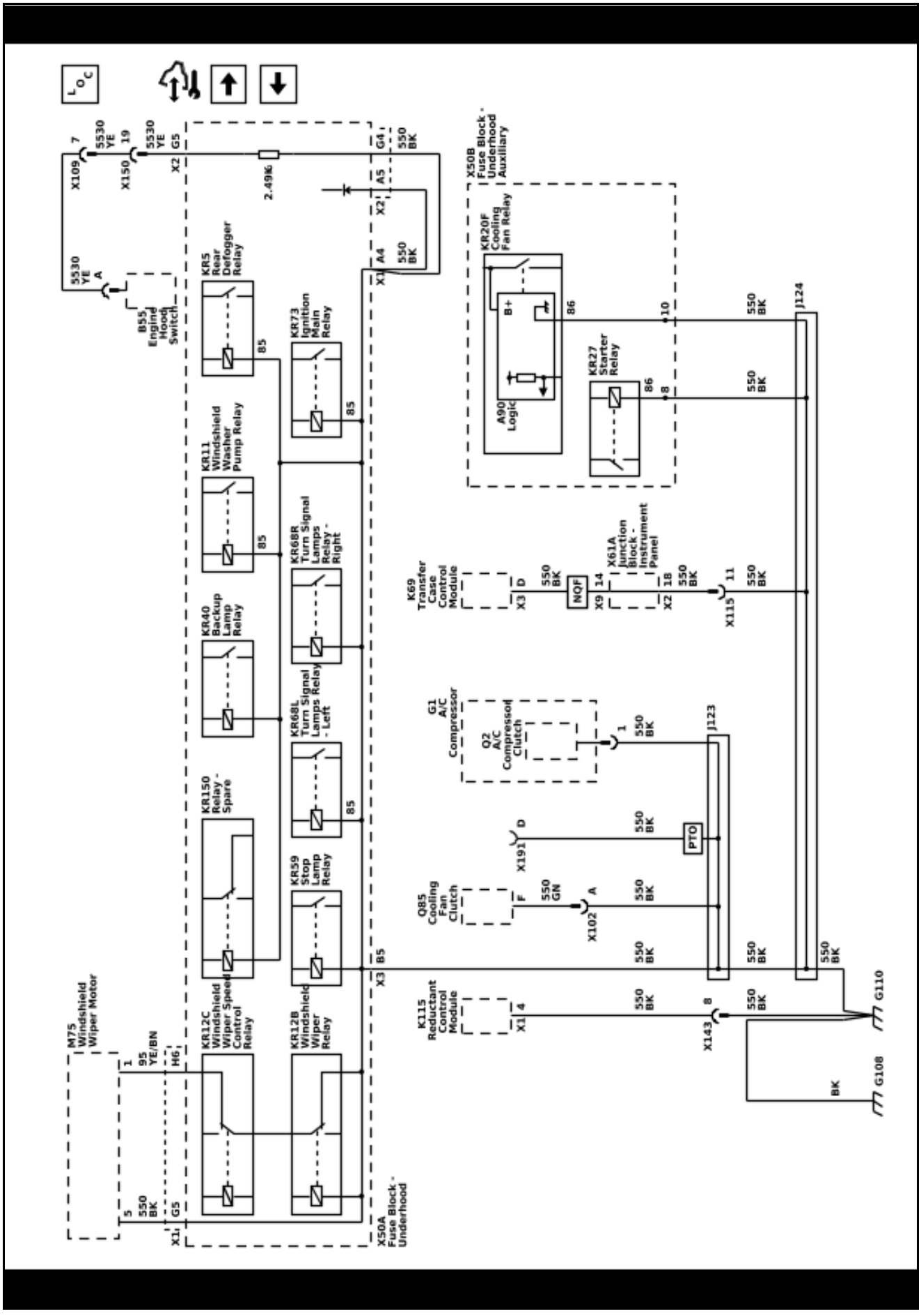
Power Moding Schematics (Retained Accessory Power Relays)



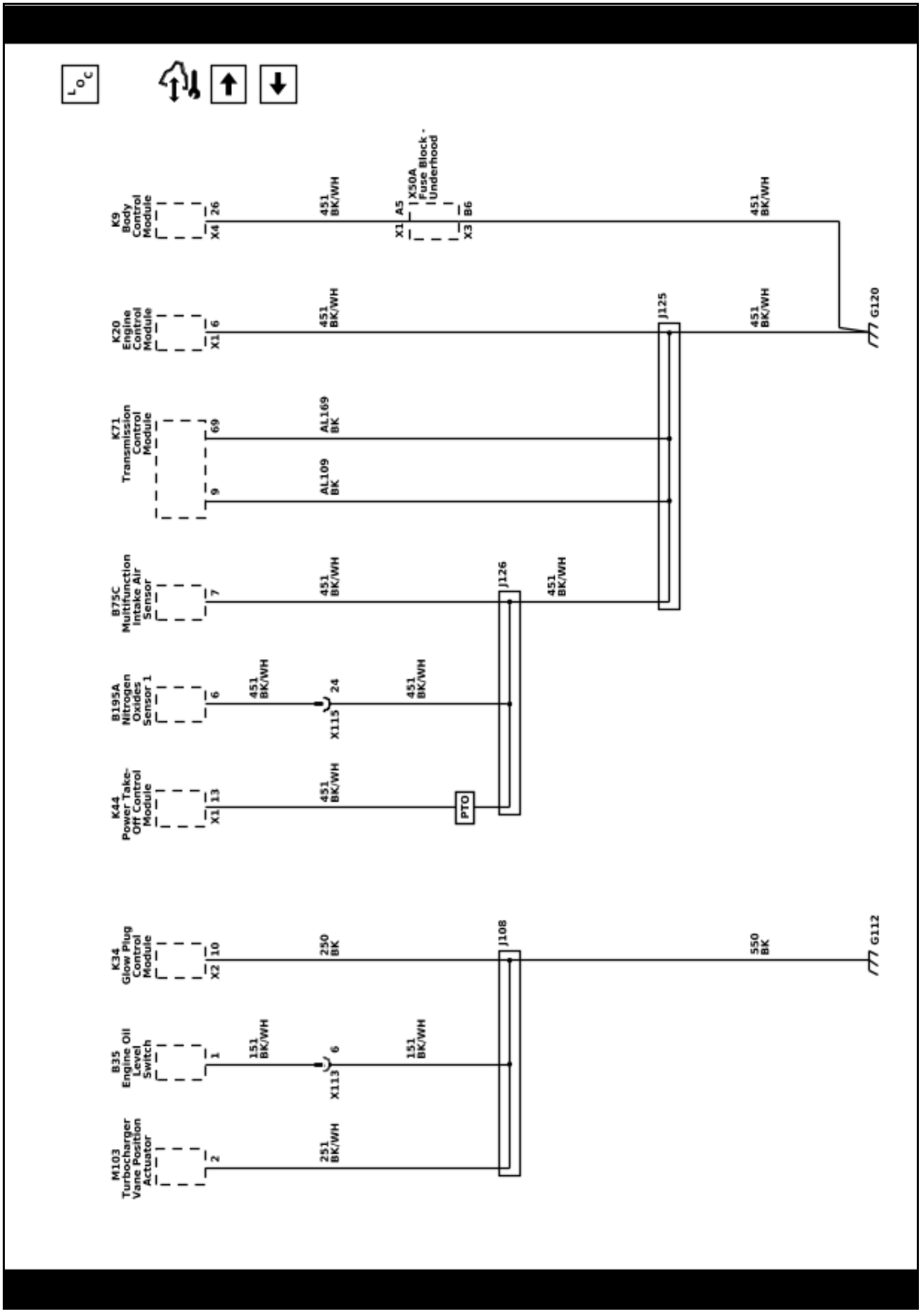
Ground Distribution Schematics (G101 and G102)



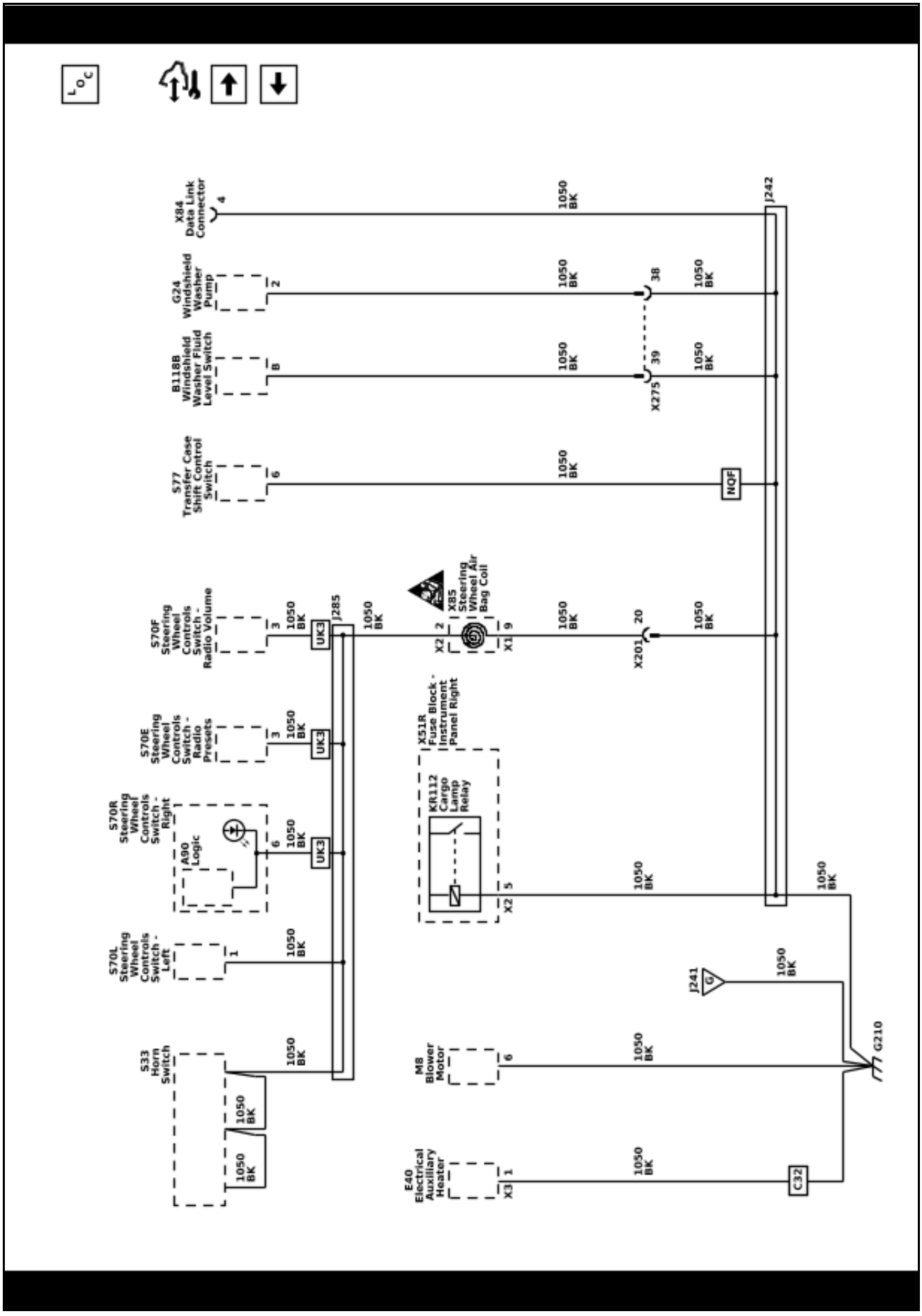
Ground Distribution Schematics (G108 and G110)



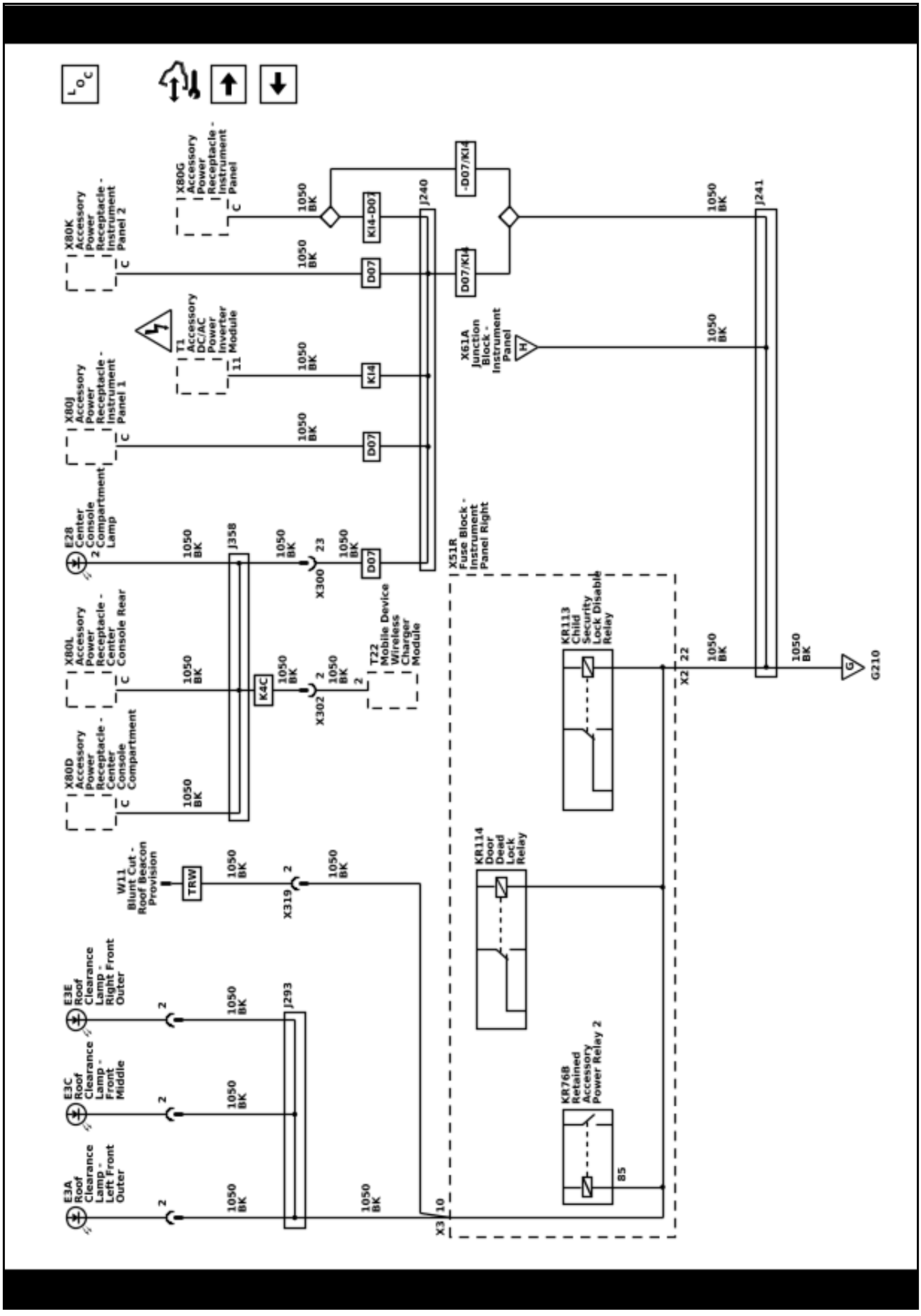
Ground Distribution Schematics (G112 and G120)



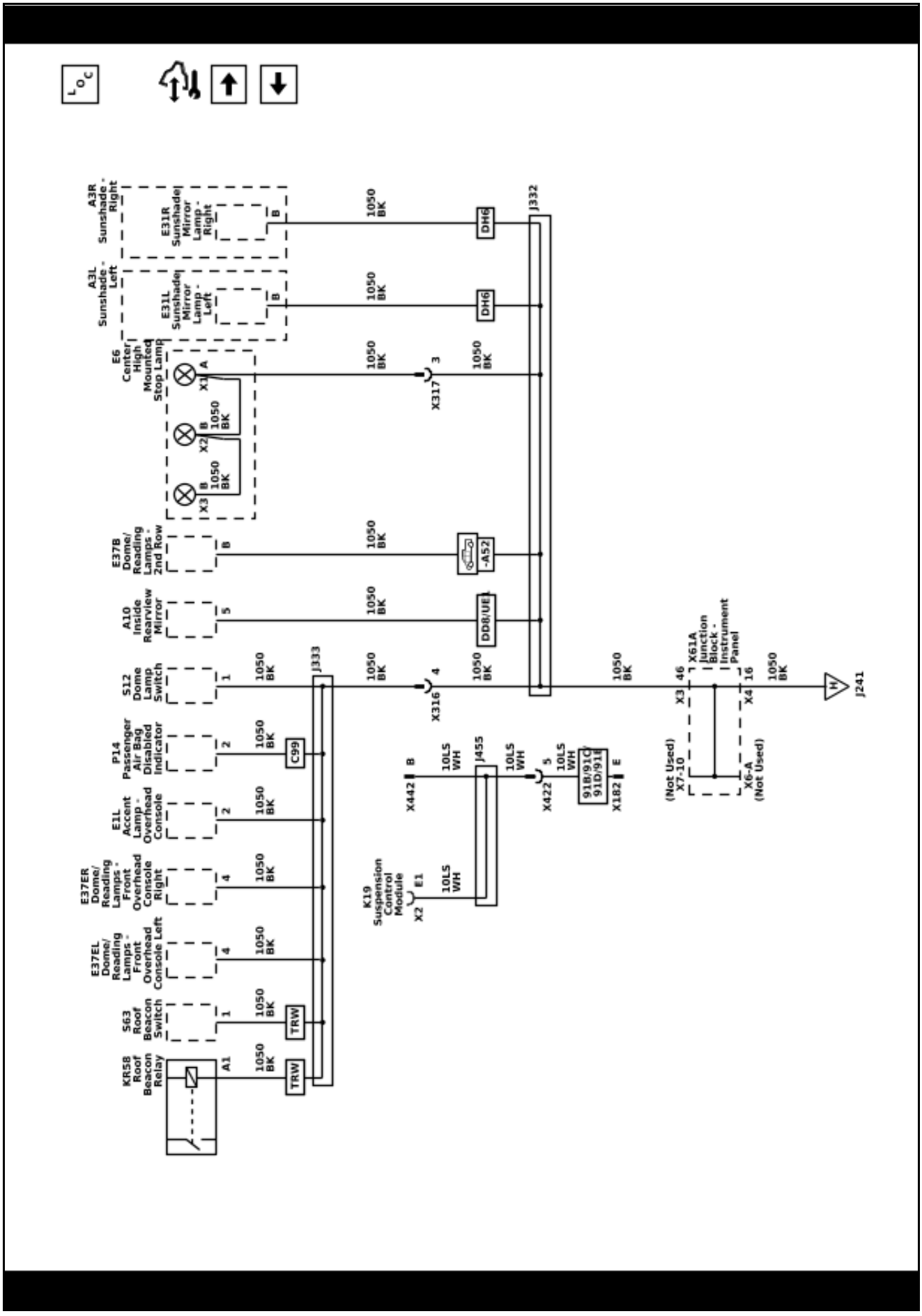
Ground Distribution Schematics (G210 (1 of 3))



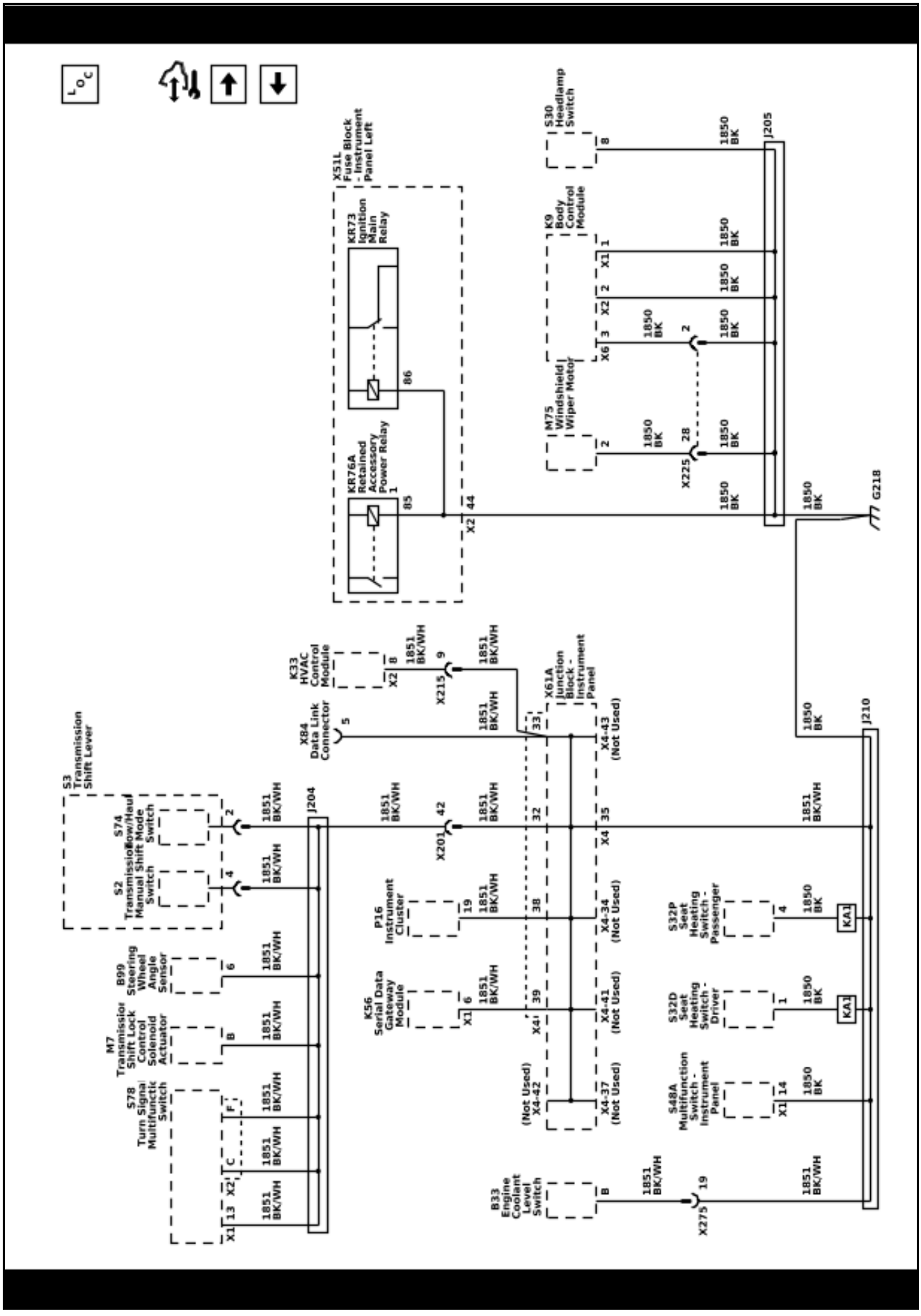
Ground Distribution Schematics (G210 (2 of 3))



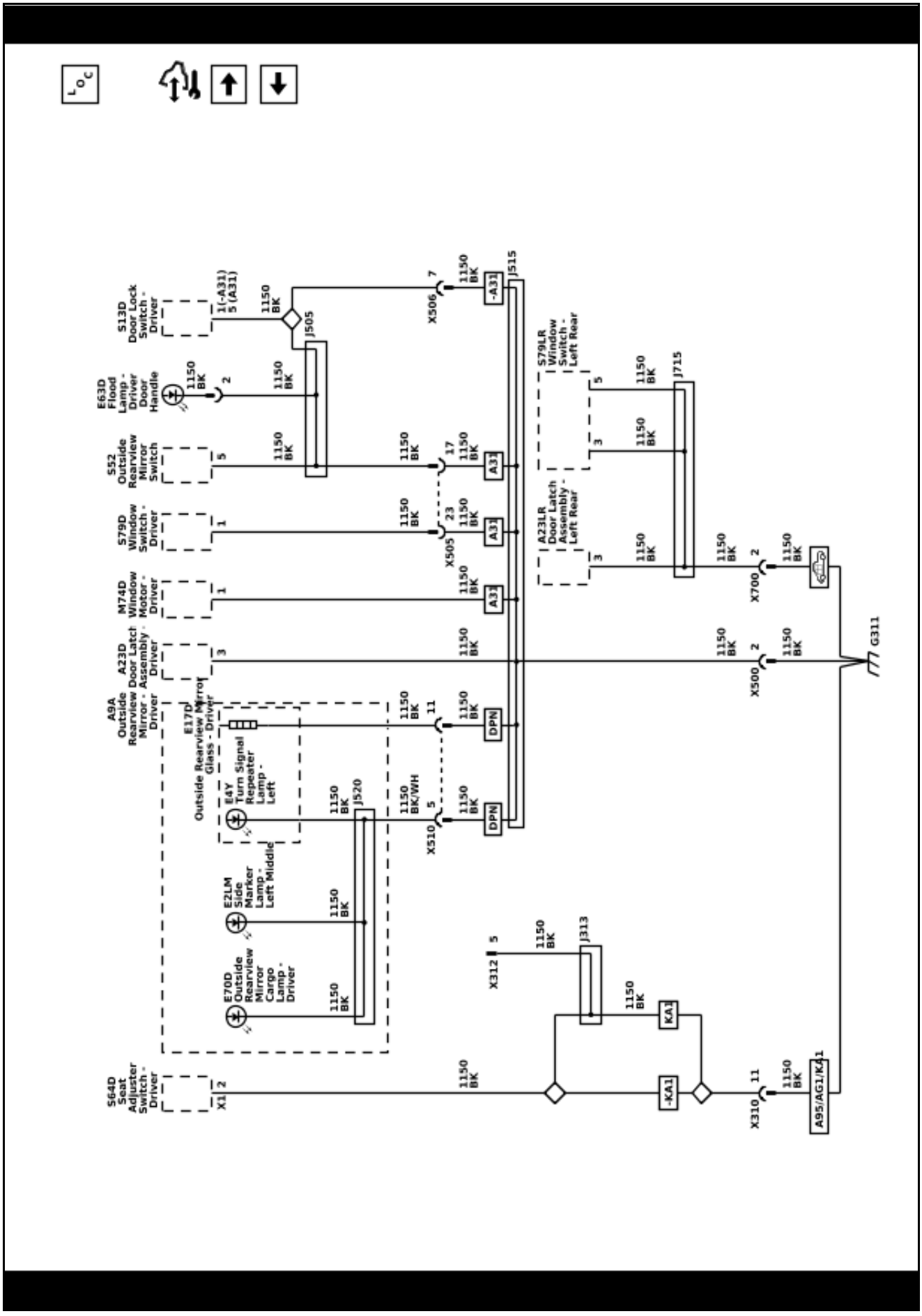
Ground Distribution Schematics (G210 (3 of 3))



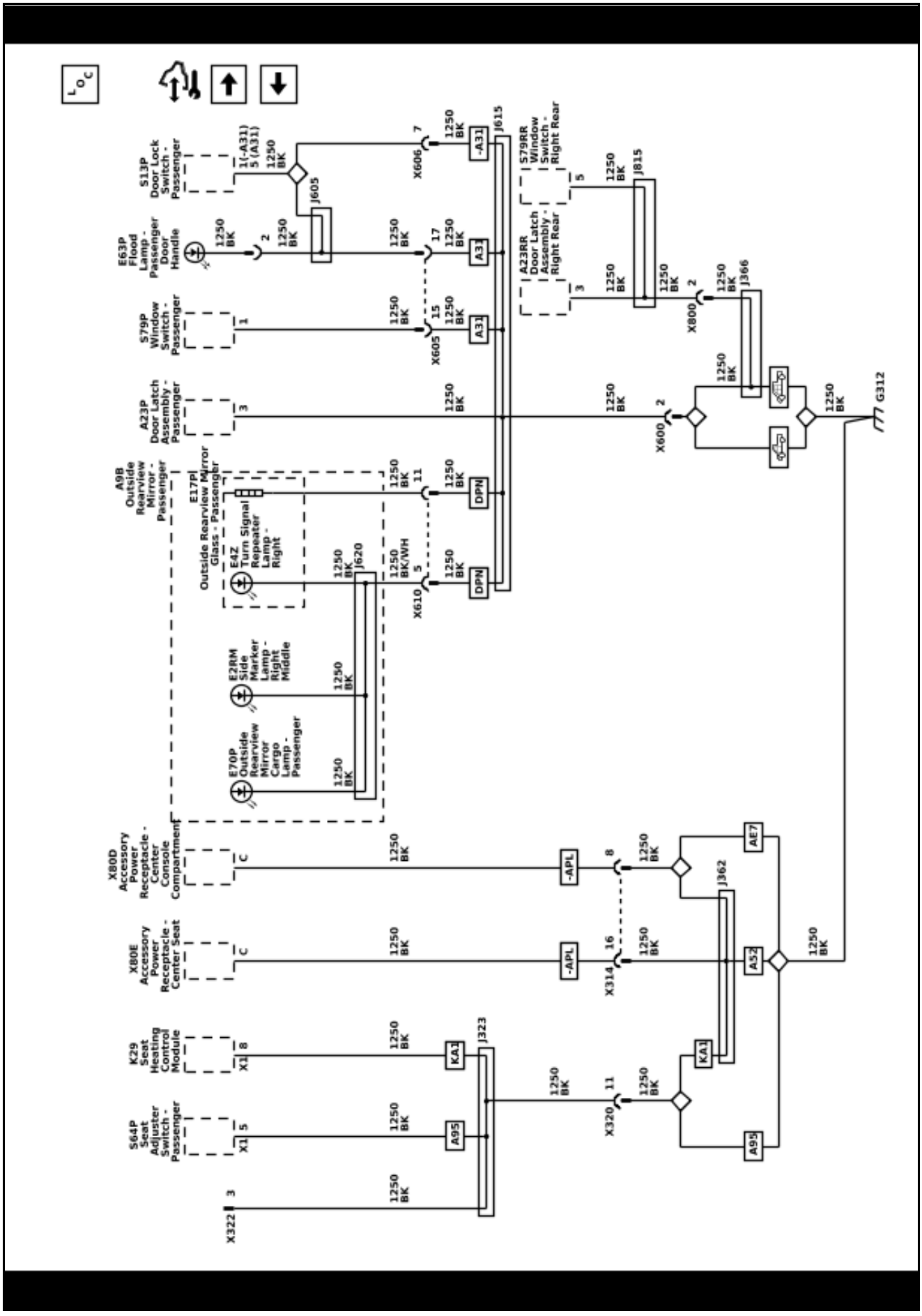
Ground Distribution Schematics (G218)



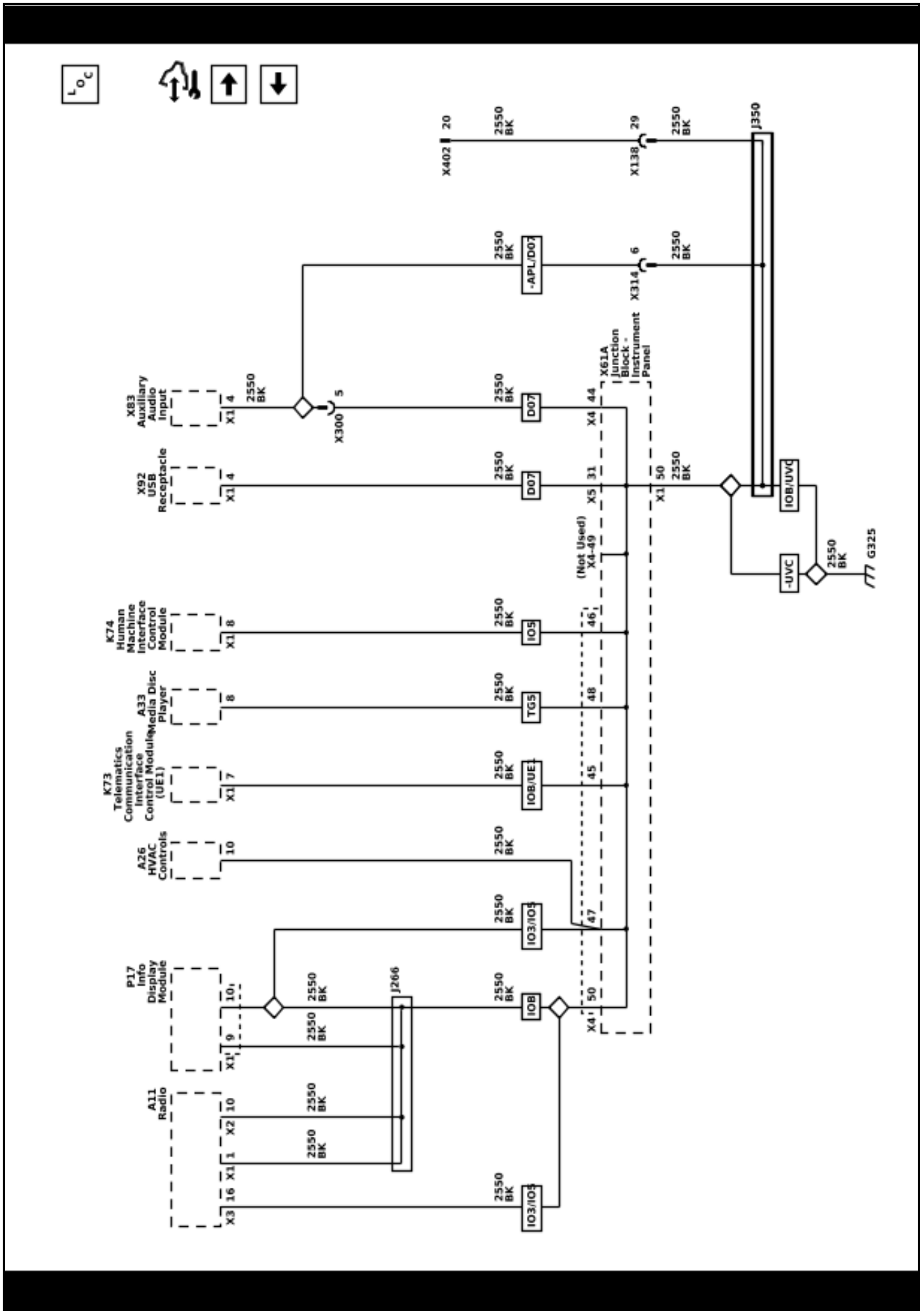
Ground Distribution Schematics (G311)



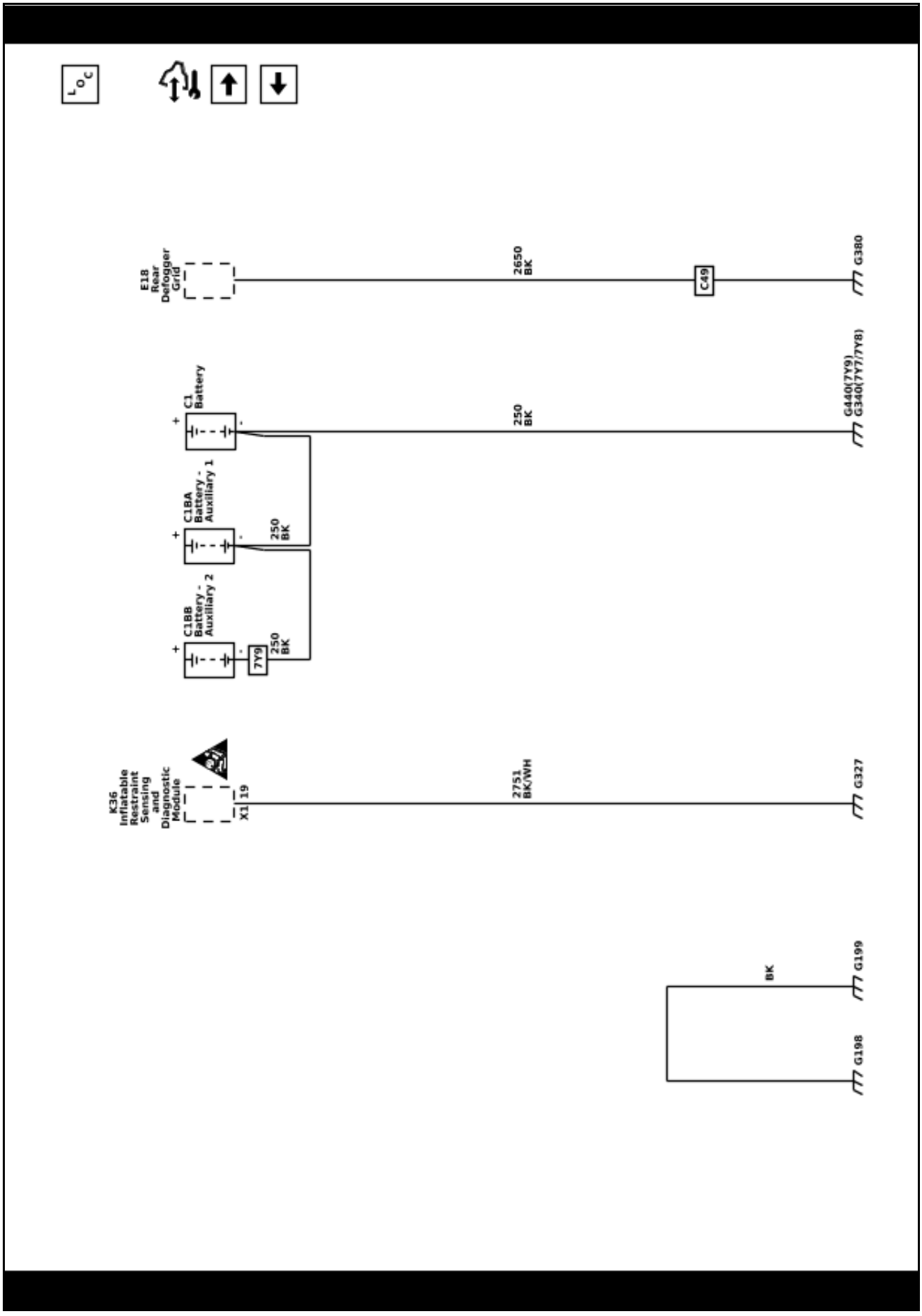
Ground Distribution Schematics (G312)



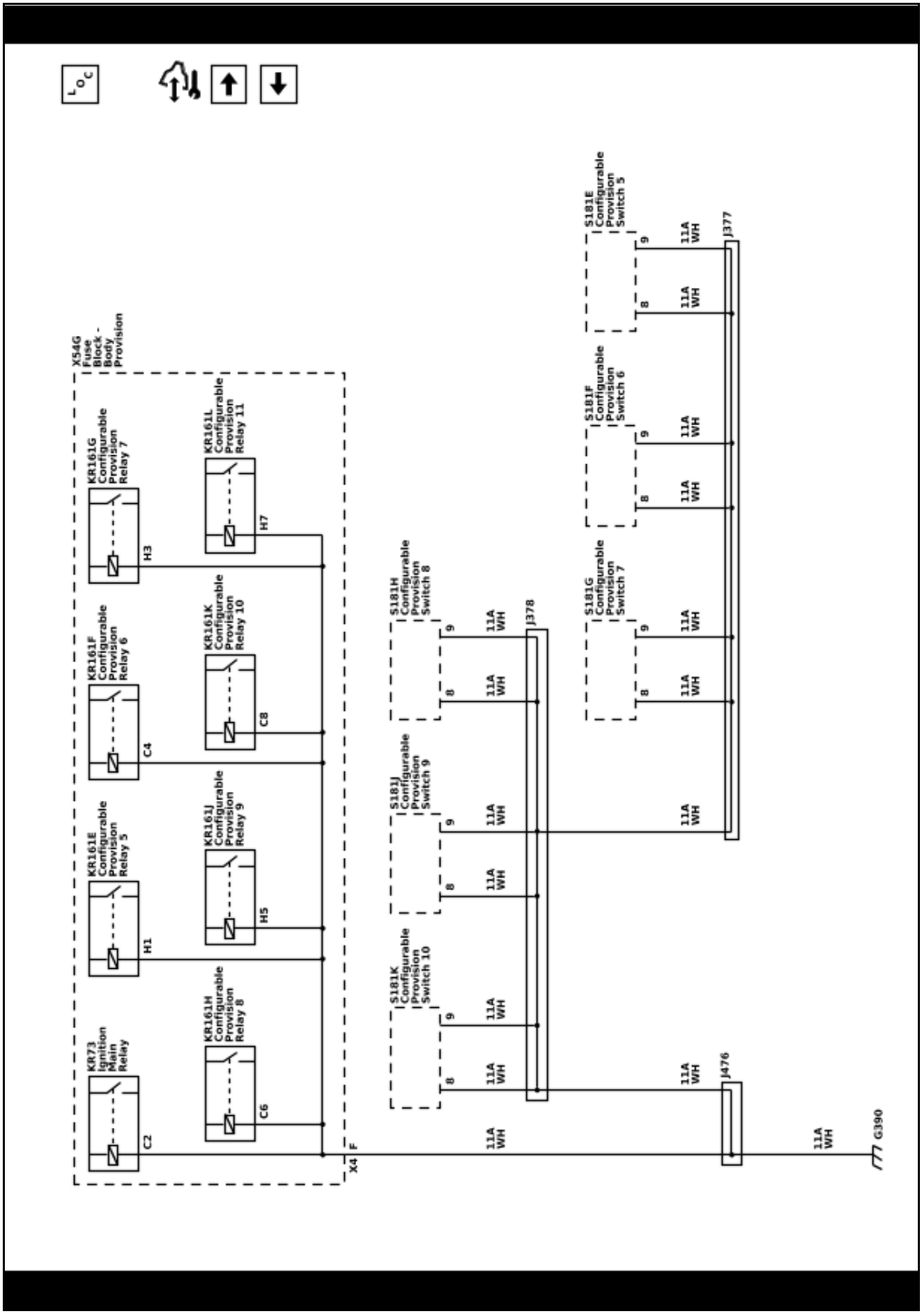
Ground Distribution Schematics (G325)



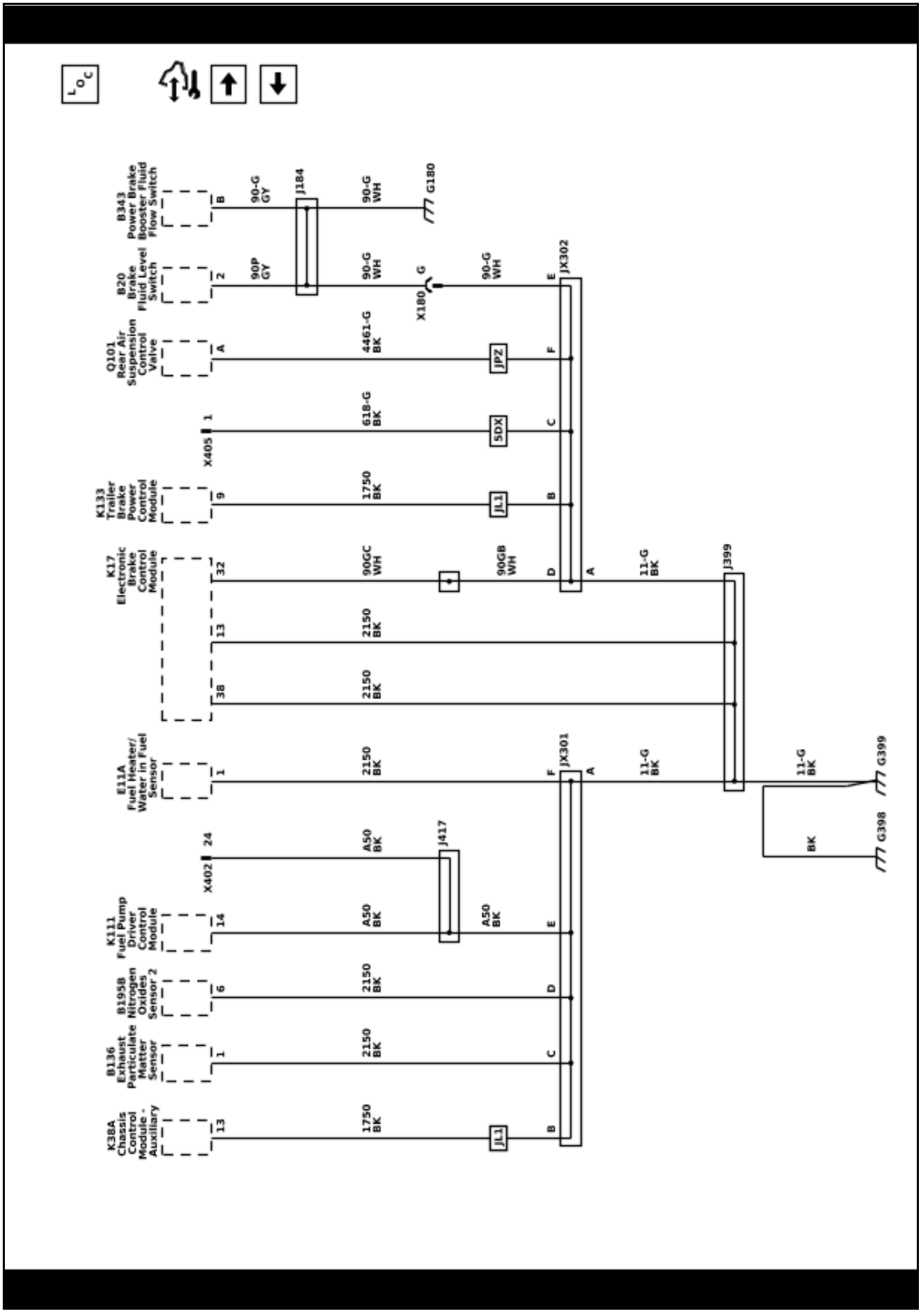
Ground Distribution Schematics (G198, G199, G327, G340, G380 and G440)



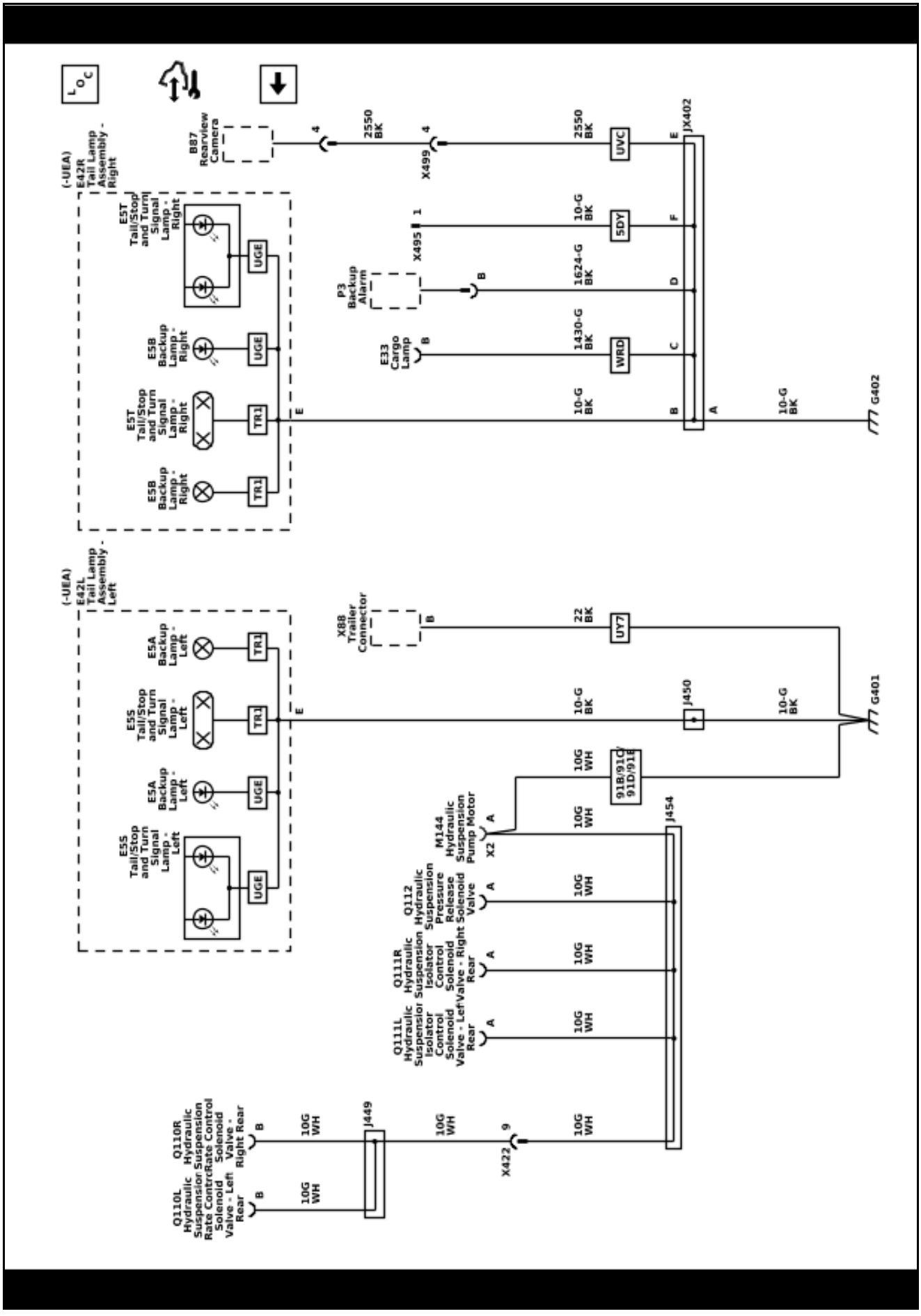
Ground Distribution Schematics (G390 (UEH))



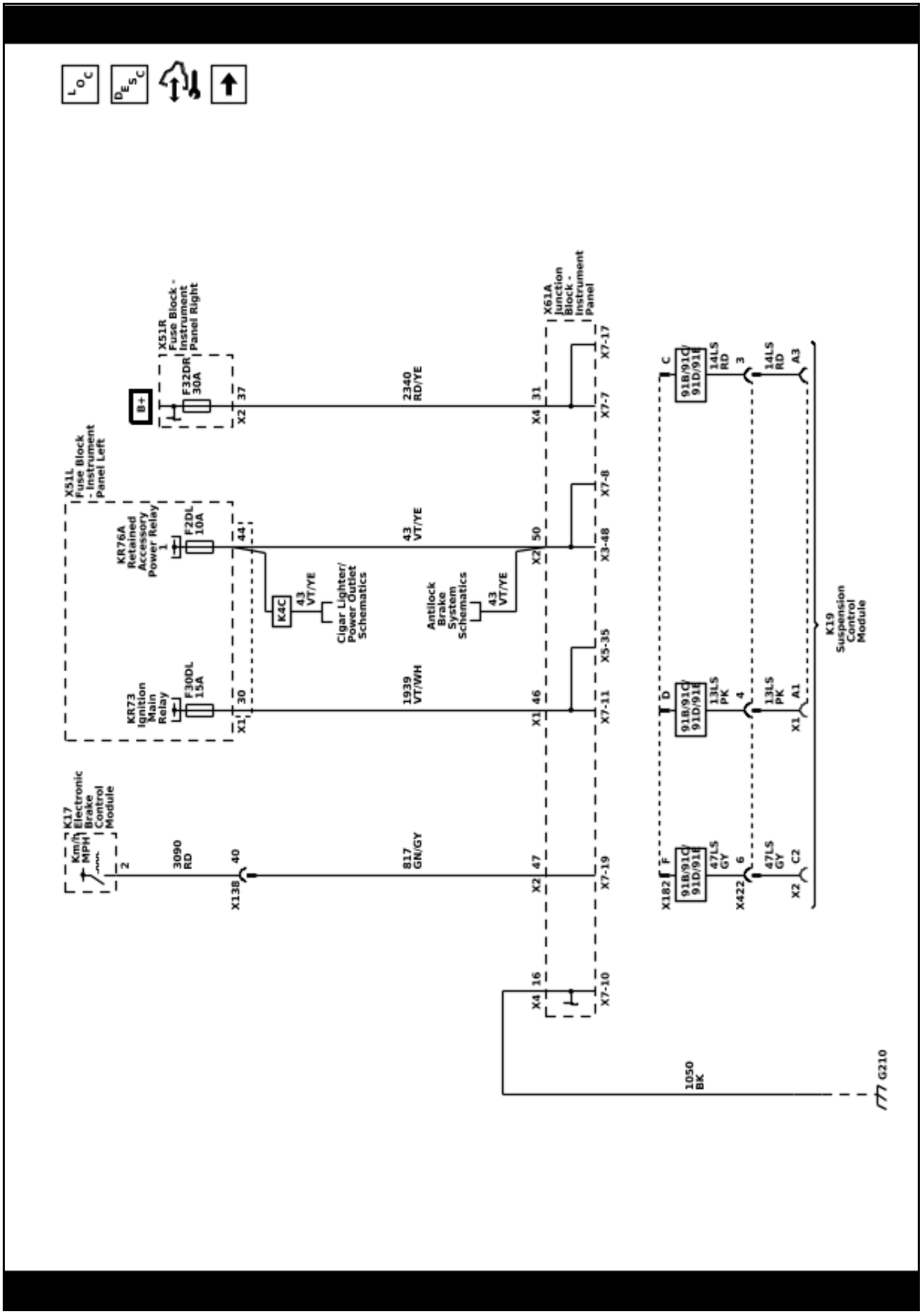
Ground Distribution Schematics (G180, G398 and G399)



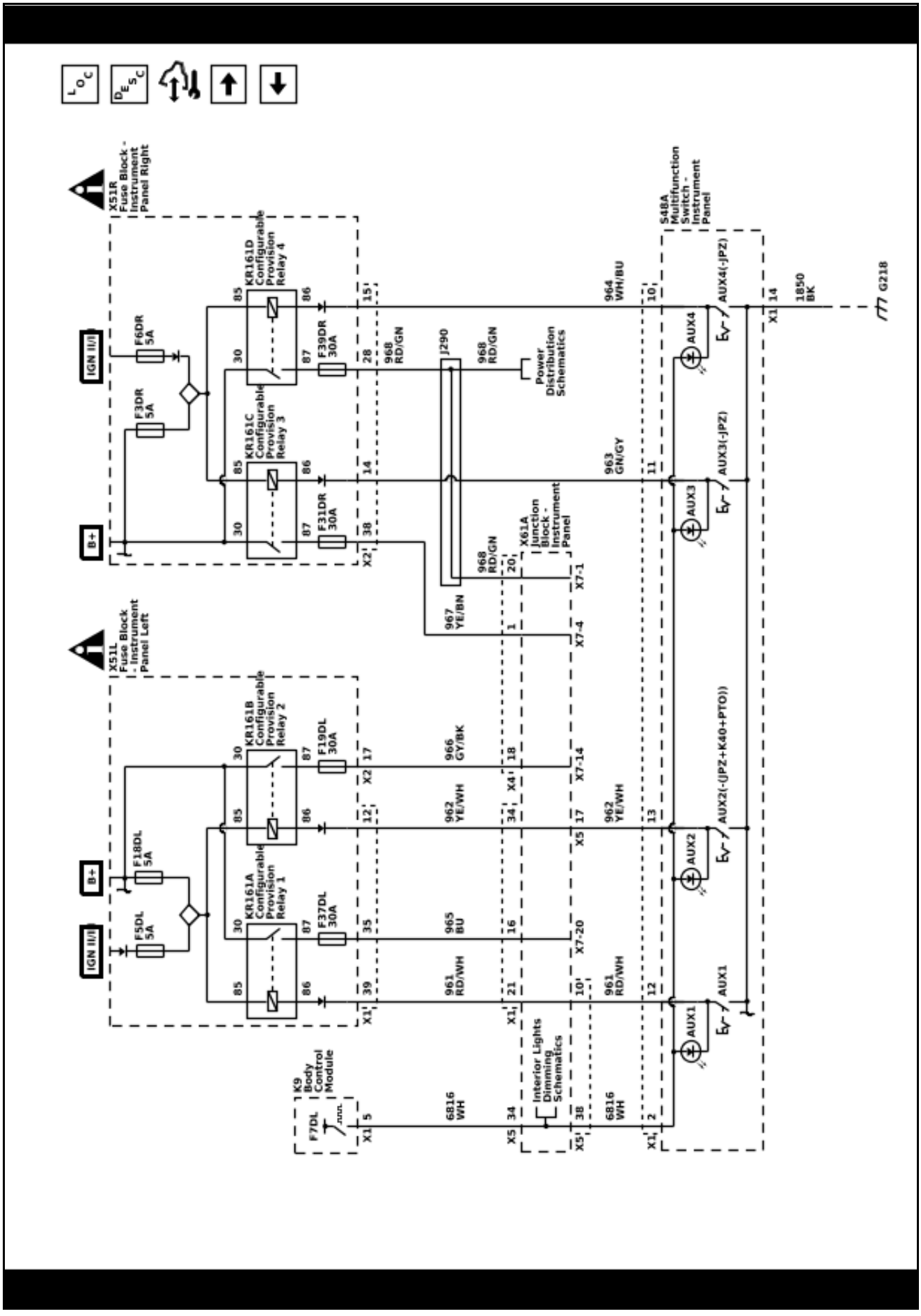
Ground Distribution Schematics (G401 and G402)



Upfitter Provision Schematics (Upfitter Provisions at Junction Block - Instrument Panel)

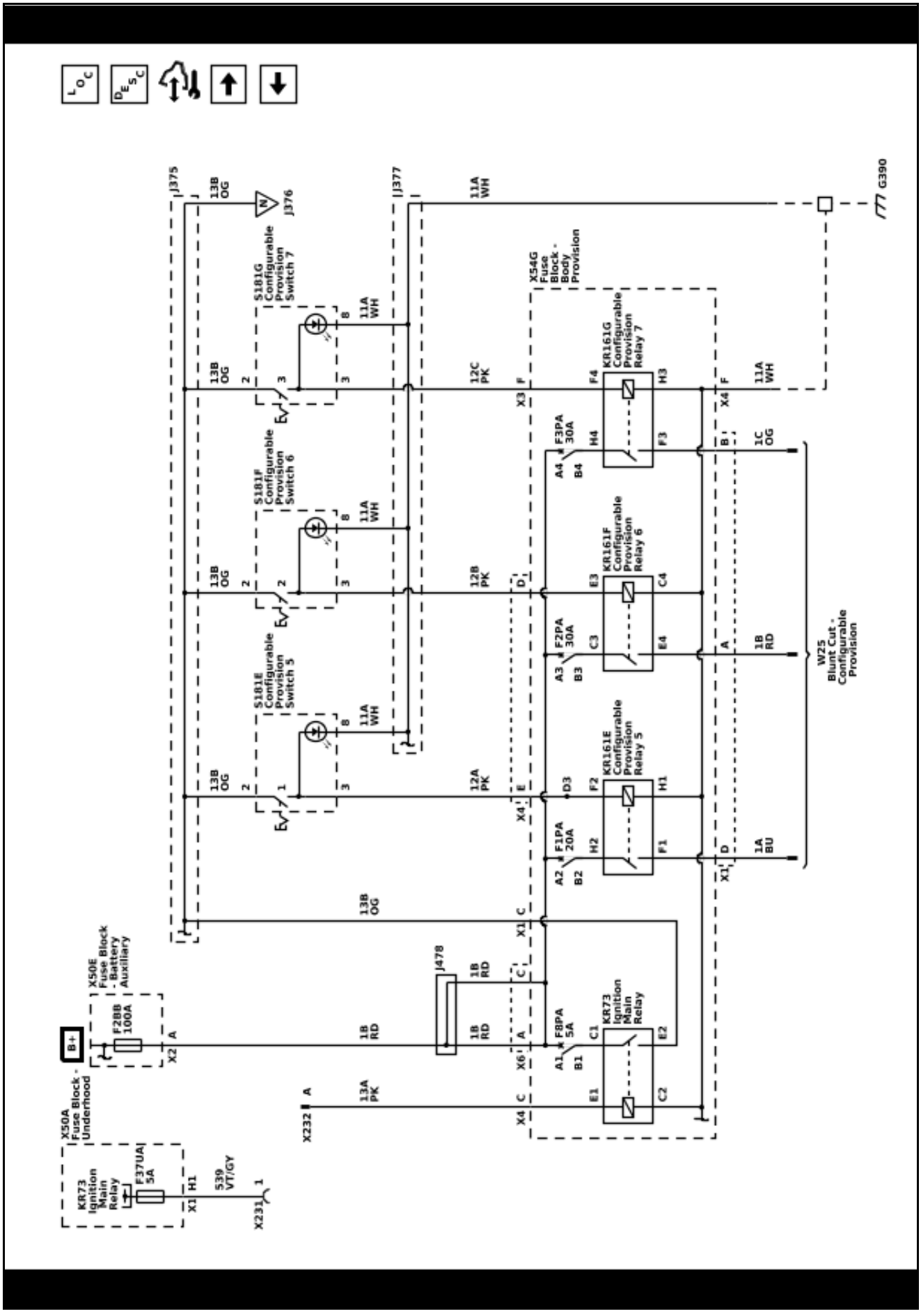


Upfitter Provision Schematics (Upfitter Provisions at Junction Block - Instrument Panel (9L7))

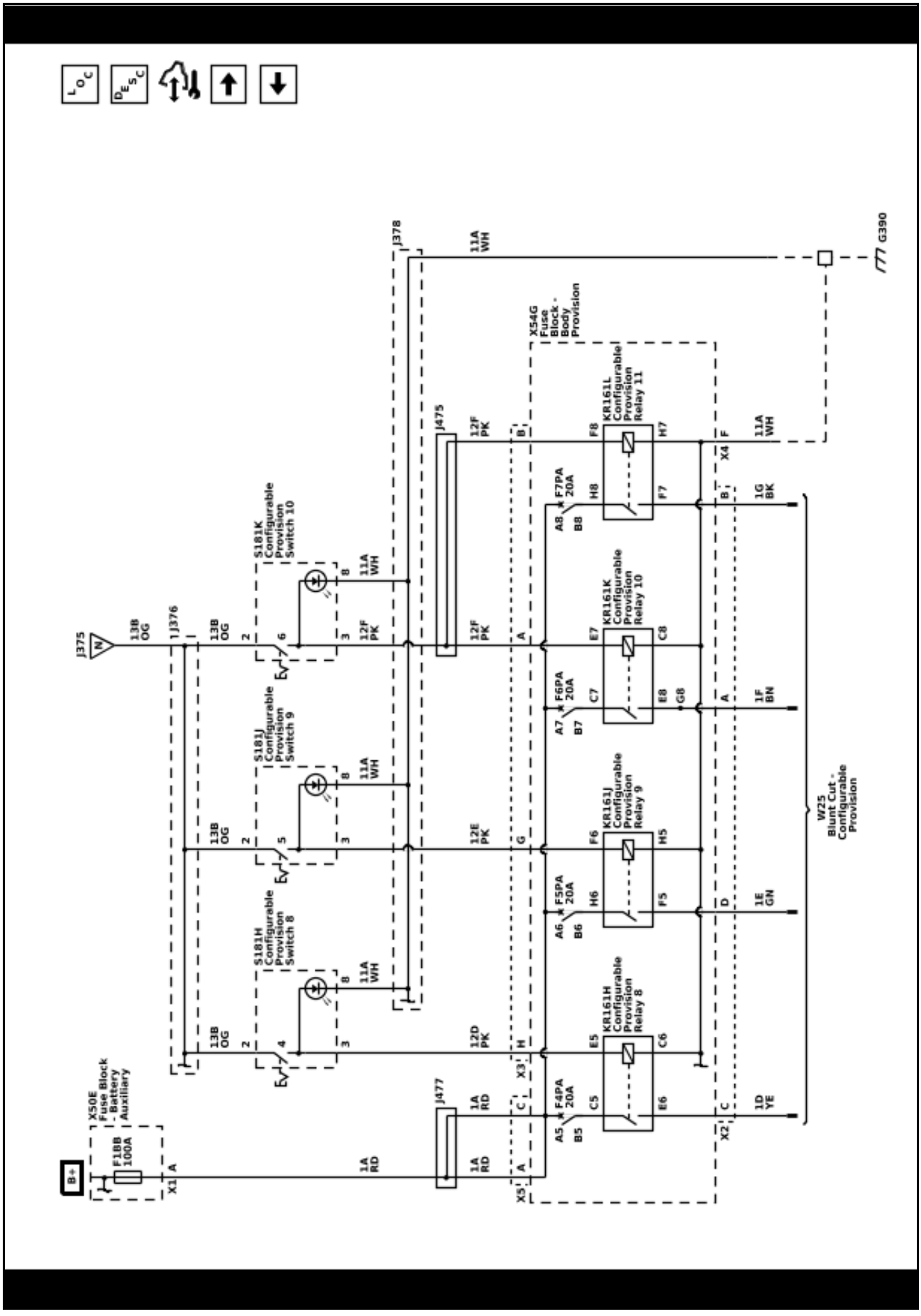


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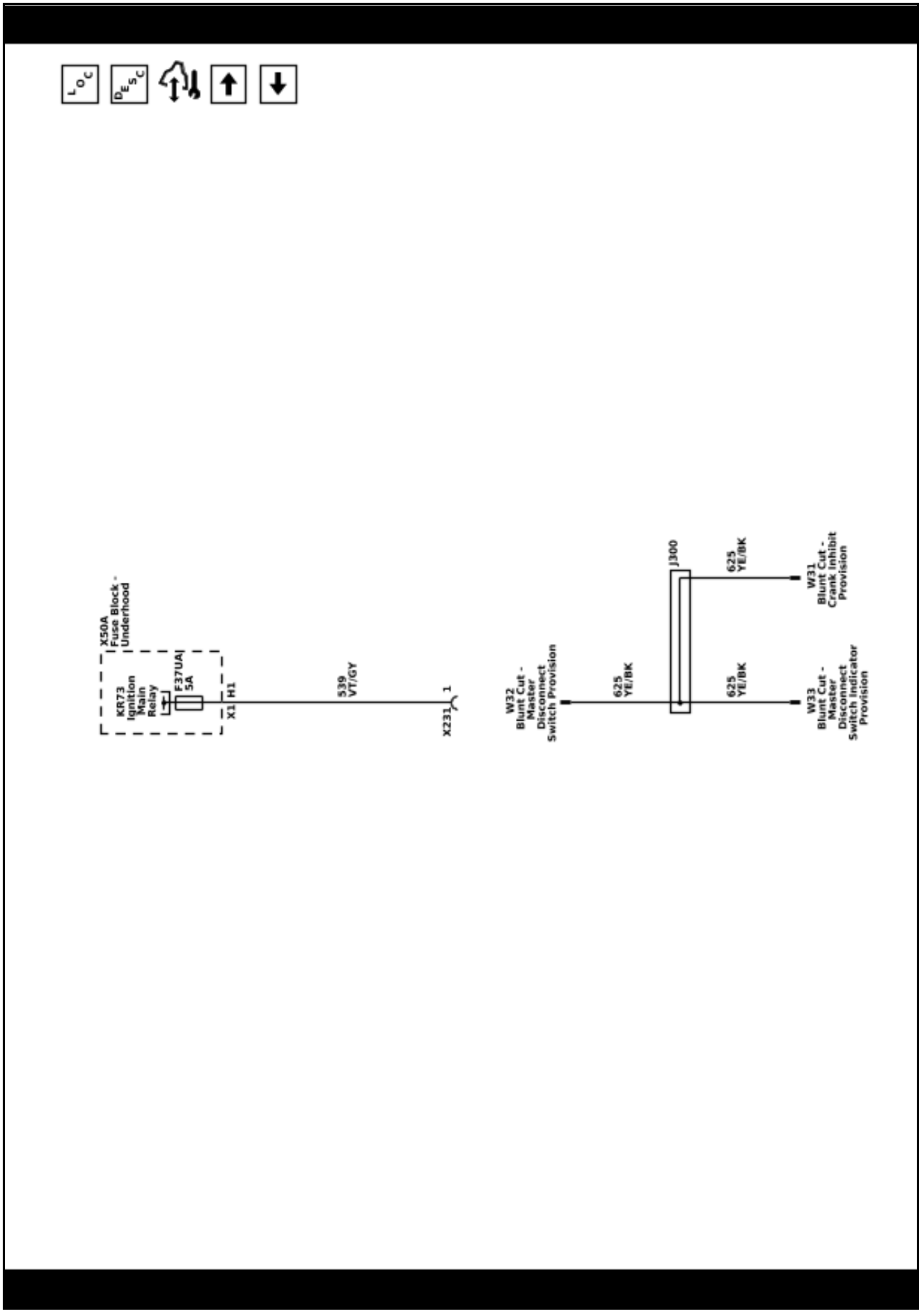
Upfitter Provision Schematics (Upfitter Provisions at Rear of Cabin (UEH) (1 of 2))



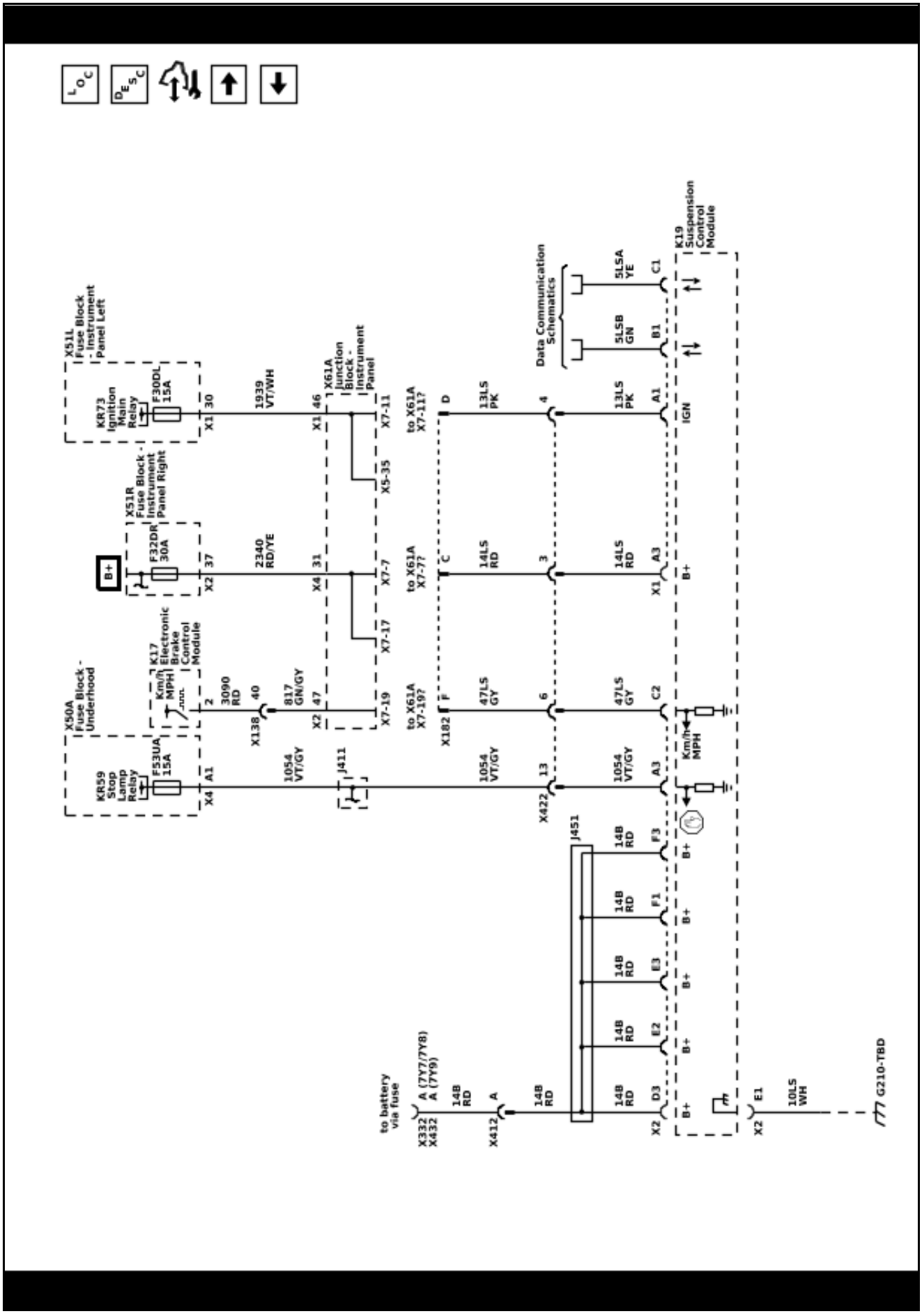
Upfitter Provision Schematics (Upfitter Provisions at Rear of Cabin (UEH) (2 of 2))



Upfitter Provision Schematics (Starter Interupt Provisions)

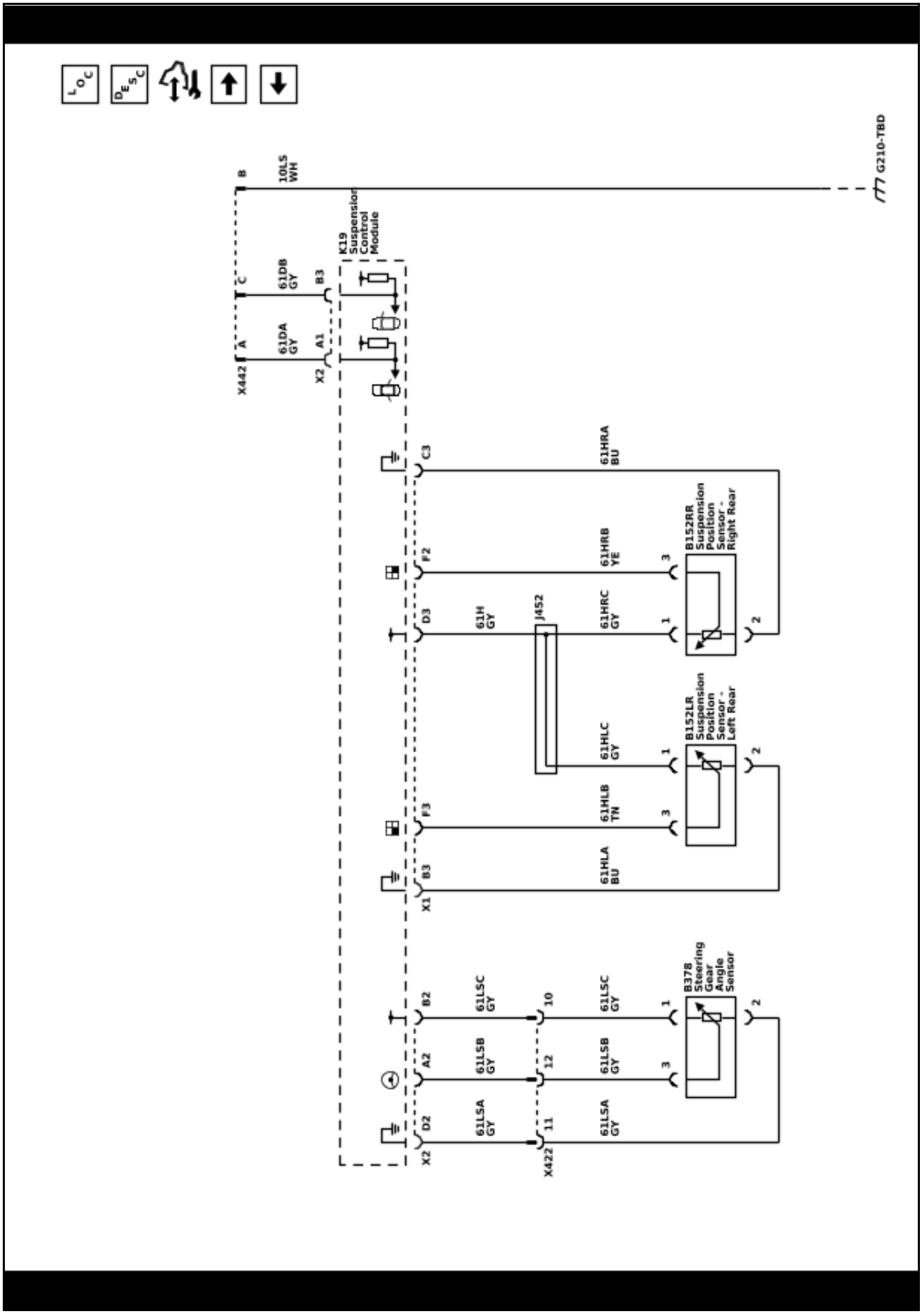


Upfitter Provision Schematics (Power, Ground, Serial Data and Signals (91B/91C/91D/91E))

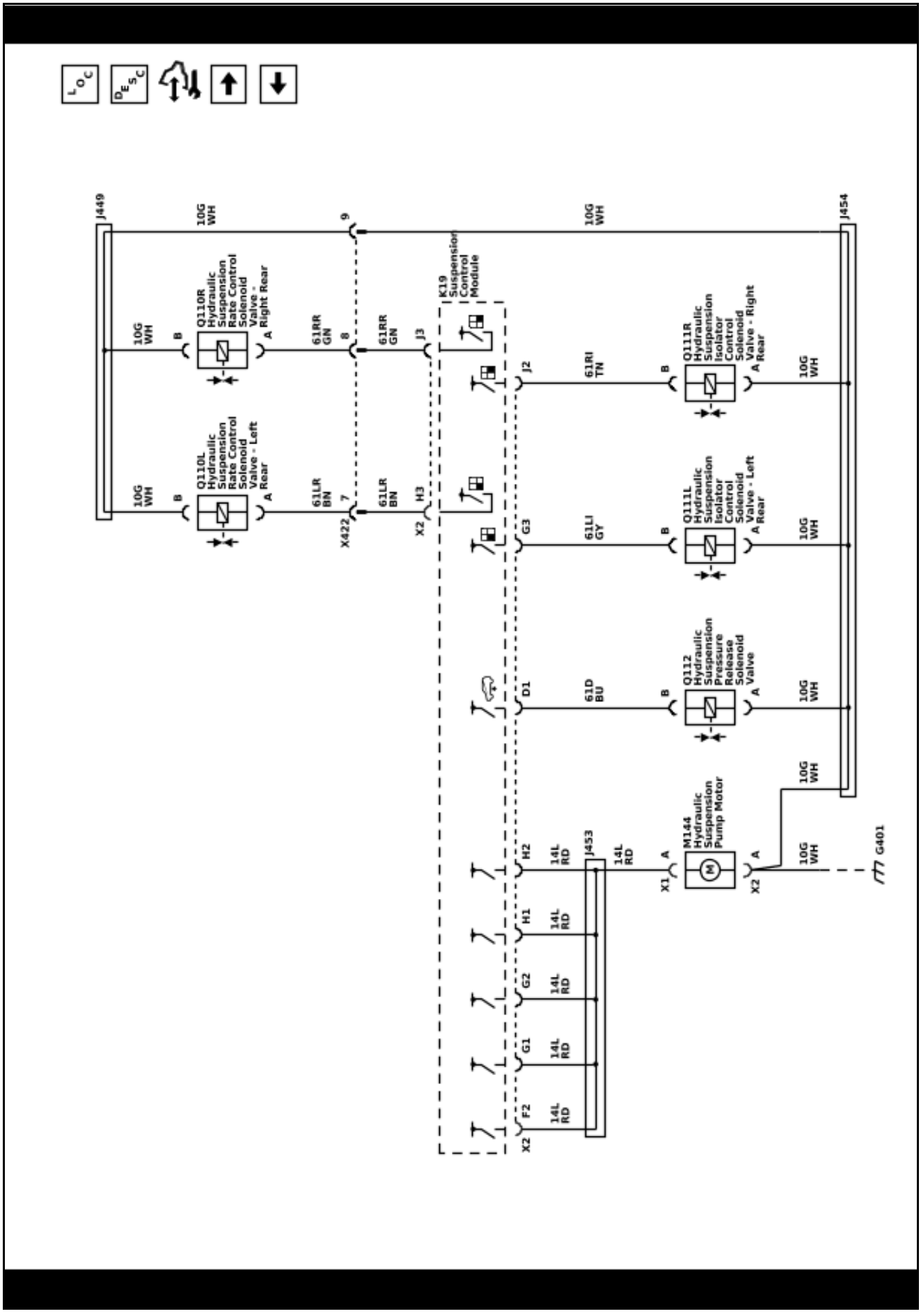


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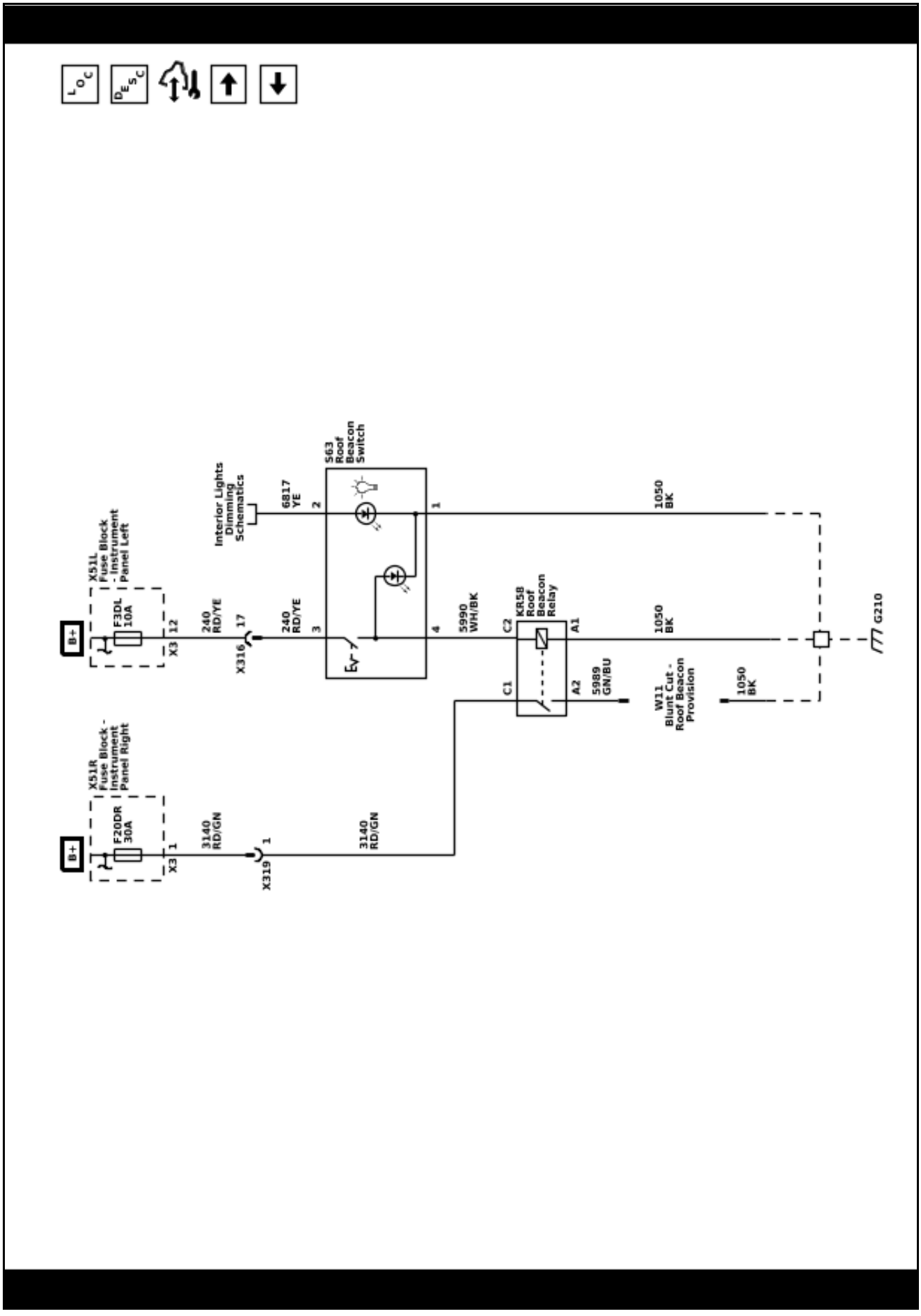
Upfitter Provision Schematics (Sensors and Door Status (91B/91C/91D/91E))



Upfitter Provision Schematics (Hydraulic Controls (91B/91C/91D/91E))



Upfitter Provision Schematics (Roof Beacon Provisions (TRW))

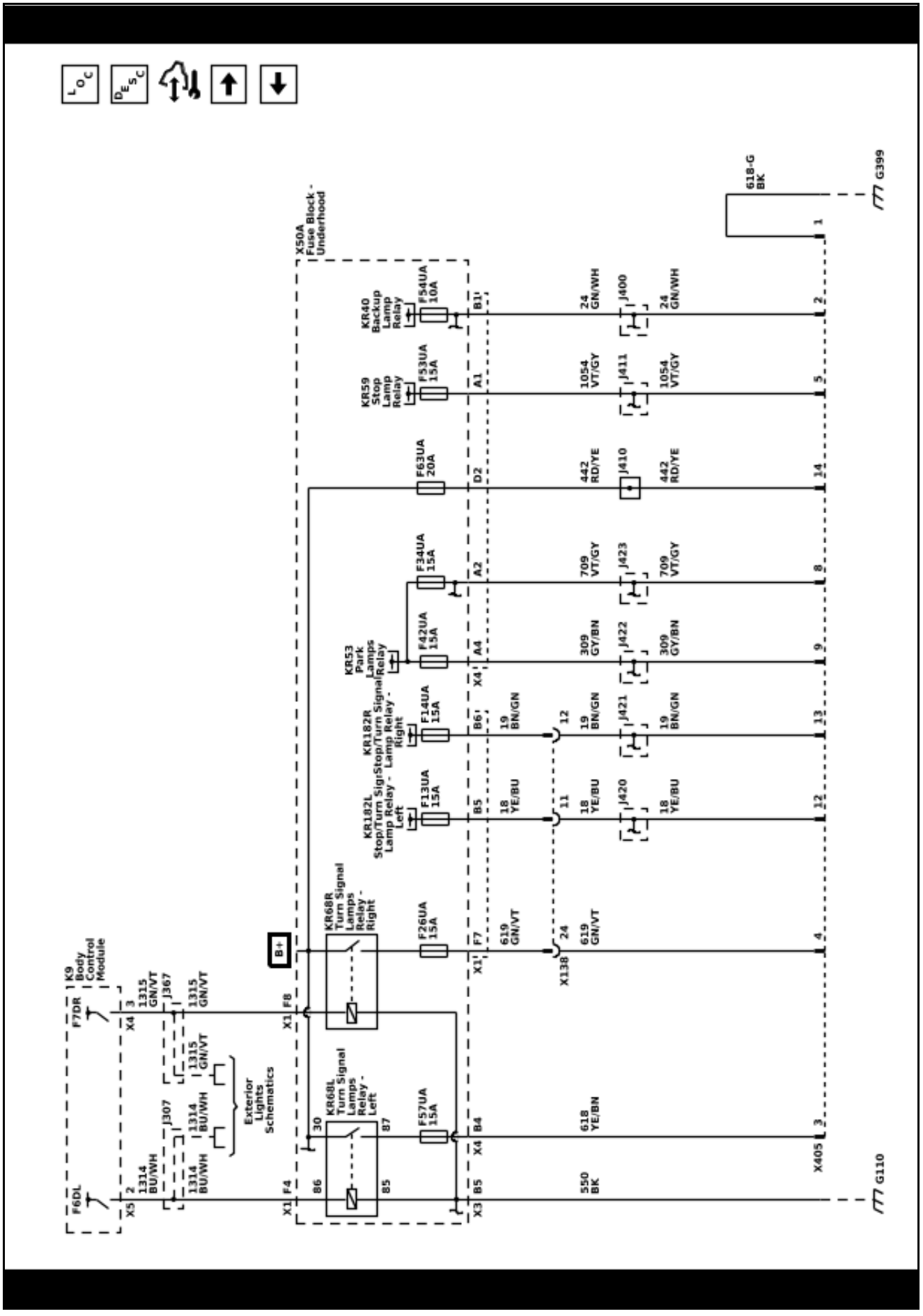


Upfitter Provision Schematics (Cargo Lamp Provision)

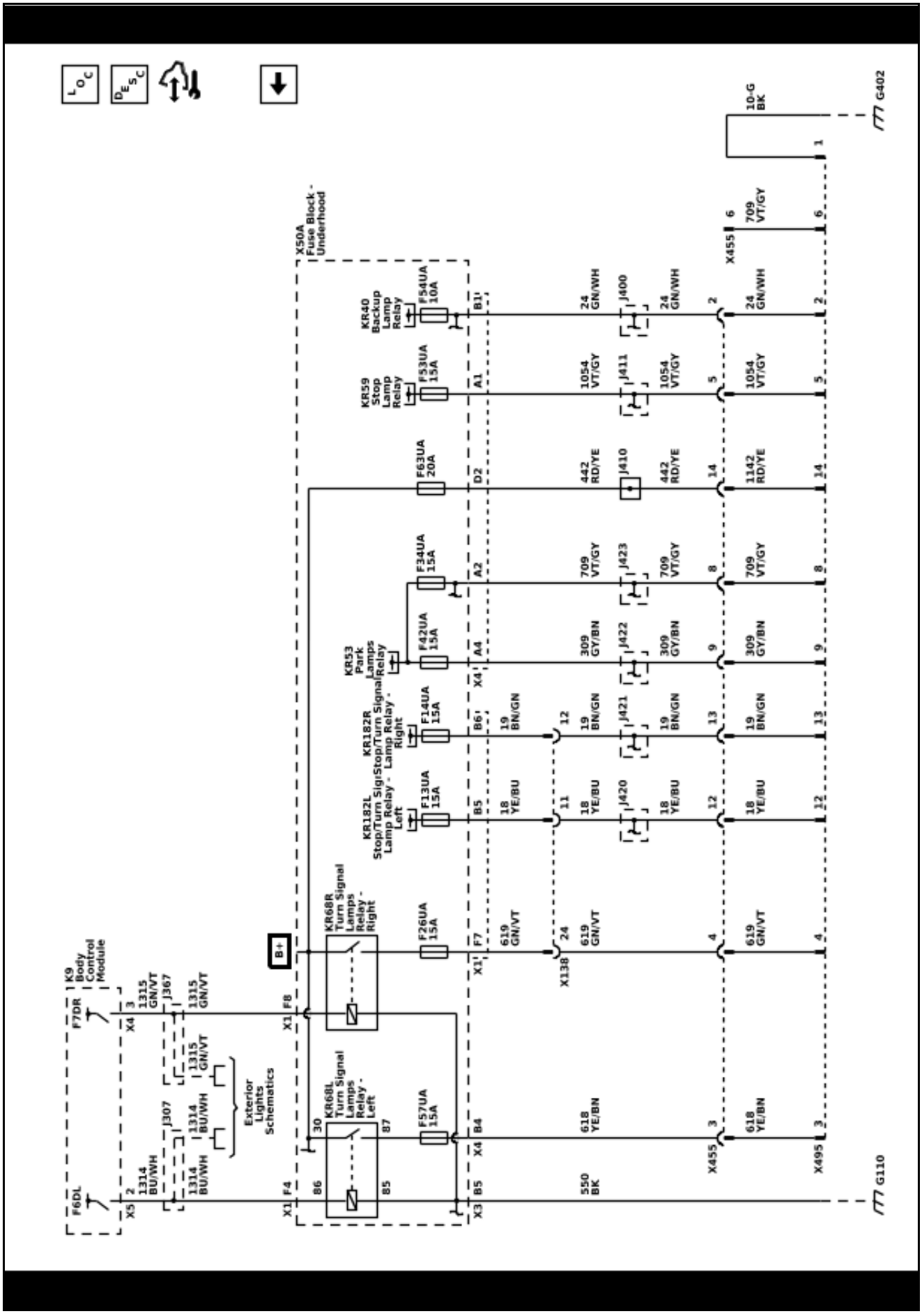


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Upfitter Provision Schematics (Rear of Cab Provisions (5DX))

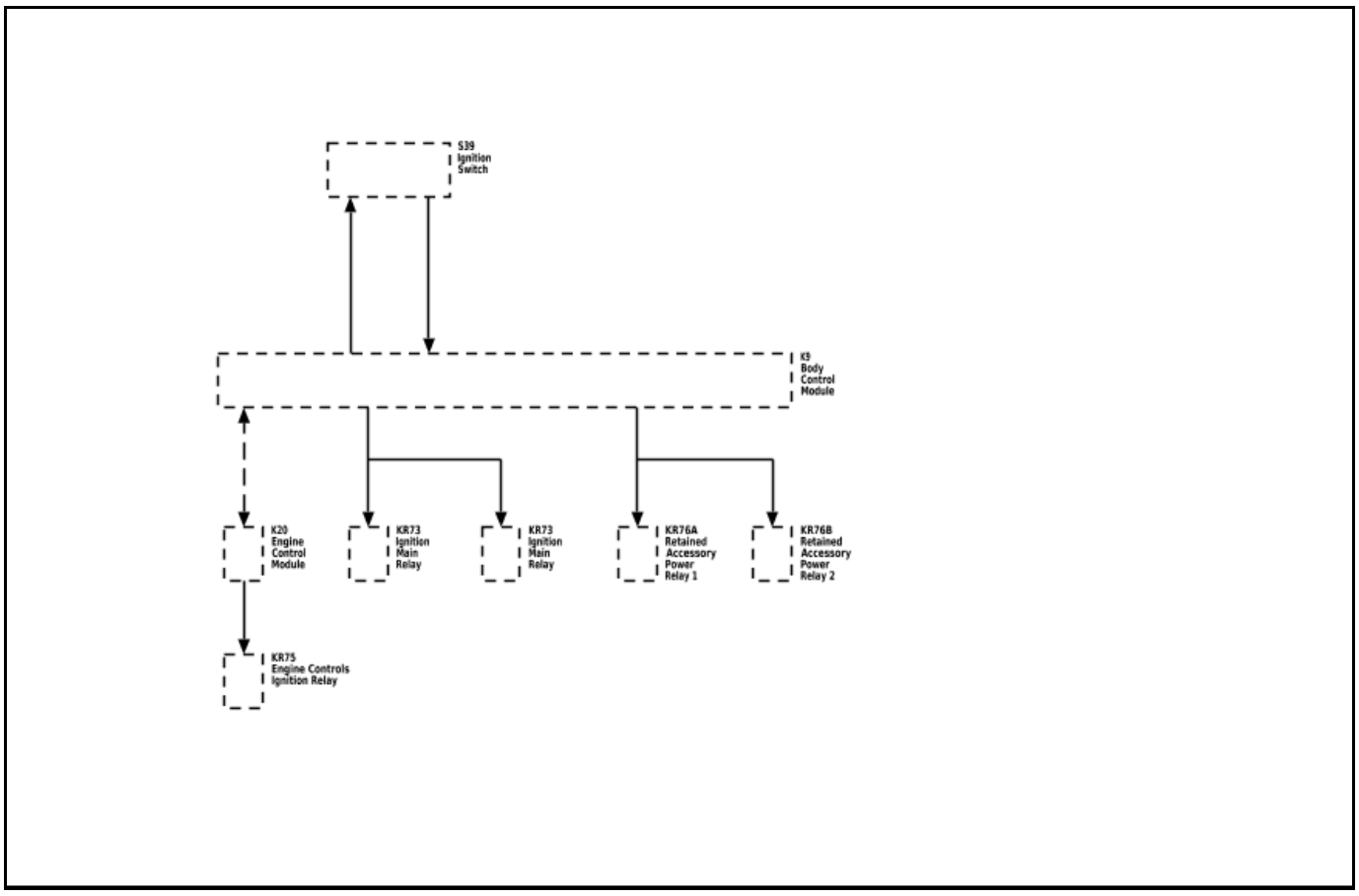


Upfitter Provision Schematics (Rear of Frame Provisions (5DY))



Description and Operation

Power Mode Description and Operation



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Power to many of this vehicles circuits is controlled by the module that is designated the power mode master. This vehicles power mode master is the body control module (BCM). The BCM has multiple B+ circuits that feed into it. Each of those circuits are partitioned within the controller to drive certain outputs of the vehicle's body functions. An open or short in any one of the B+ circuits may induce multiple codes/or a section of non-functionality within the BCM with the rest of the BCM functioning normally. In this case it is useful to refer to the power distribution schematics to determine if the non-functional partition of the controller shares a common B+ circuit. The ignition switch is a low current switch with multiple discrete ignition switch signals to the power mode master for determination of the power mode that will be sent over the serial data circuits to the other modules that need this information. The power mode master will also activate relays and other direct outputs of the power mode master as needed. The power mode master determines which power mode (Off, Accessory, Run, Crank Request) is required, and reports this information to other modules via serial data. Modules which have switched voltage inputs may operate in a default mode if the power mode serial data message does not match what the individual module can see from its own connections.

The power mode master receives ignition switch signals to identify the operators desired power mode. The Power Mode Parameter tables below illustrate the correct state of these input parameters (circuits) in correspondence to the ignition switch position:

Power Mode Parameters

Ignition Switch Position	Power Mode Transmitted	Ign. Off/Run/Crank (Off/Run Crank Voltage Circuit)	Ignition Accessory/Run (Accessory Voltage Circuit)	Ignition Run/Crank (Ignition 1 Voltage Circuit)
Off Key Out	Off	Key Out / ACC	Inactive	Inactive
Off Key IN	Off	Key In / Off	Inactive	Inactive
Accessory	Accessory	Key Out / ACC	Active	Inactive
Run	Run	Run	Active	Active

Power Mode Parameters (cont'd)

Ignition Switch Position	Power Mode Transmitted	Ign. Off/Run/Crank (Off/Run Crank Voltage Circuit)	Ignition Accessory/Run (Accessory Voltage Circuit)	Ignition Run/Crank (Ignition 1 Voltage Circuit)
Start	Crank Request	Crank	Inactive	Active

Relay Controlled Power Mode

The BCM uses the discrete ignition switch inputs Off/Run/Crank Voltage, Accessory Voltage, and Ignition 1 Voltage, to distinguish the correct power mode. The BCM, after determining the desired power mode, will activate the appropriate relays for that power mode.

The retained accessory power relay 1 and retained accessory power relay 2 remain on for a timed period after the Ignition key is removed. Refer to *Retained Accessory Power Description and Operation on page 7-255* for more information on the retained accessory power function.

Transport Mode

Transport mode reduces the parasitic load of some modules during vehicle shipping and/or during vehicle storage conditions. This improves the drain time on the battery (up to 70 days without the battery going dead). When a vehicle is in transport/storage, some features may be disabled or have reduced functionality while enabled, such as keyless entry, afterblow, and content theft features.

Transport mode is initiated by turning on the hazard flashers, applying the brake pedal, and then turning and holding the ignition key to the start position with the brake pedal applied for greater than 15 s. The mode is disengaged by repeating the previous process. The driver information center (if equipped) will temporarily display Transport Mode is On when it enables and Transport Mode is OFF when it disables. For vehicles not equipped with a driver information center, the battery indicator light will constantly flash on the Instrument Cluster when enabled. This feature can be used as many times as necessary if the vehicle is to be stored for an extended period of time.

BCM Awake/Sleep States

The BCM is able to control or perform all of the BCM functions in the awake state. The BCM enters the sleep state when active control or normal monitoring of system functions has stopped and a time limit has passed. The BCM must detect certain wake-up inputs before entering the awake state. The BCM monitors for these inputs during the sleep state.

The BCM will enter the awake state if any of the following wake-up inputs are detected:

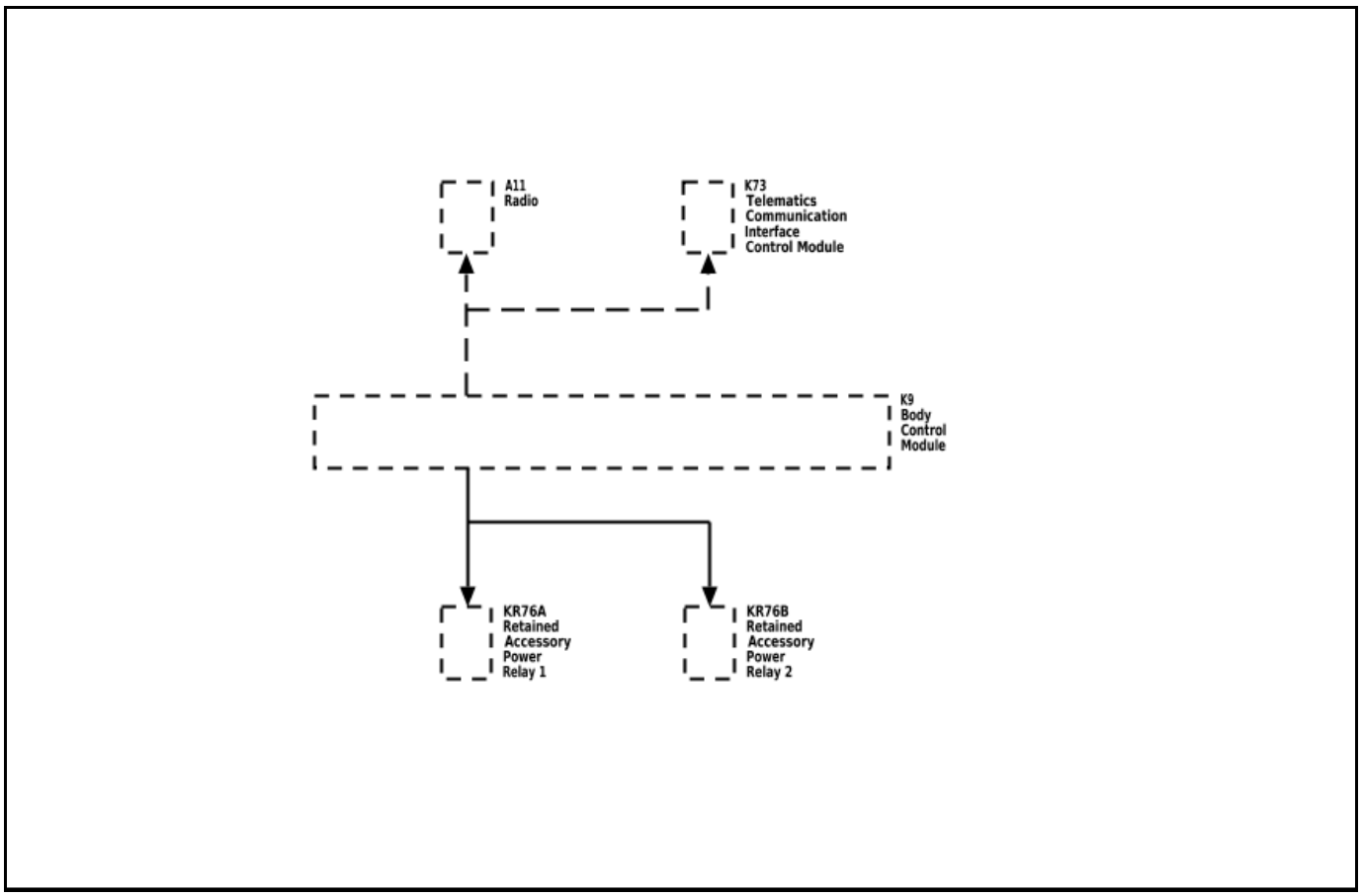
- Activity on the serial data line
- Detection of a battery reconnect
- Any door open signal
- Headlamps ON
- Key-in-ignition
- Ignition ON
- Park lamps ON
- Keyless entry or remote start message

The BCM will enter a sleep state when all of the following conditions exist:

- The ignition switch is OFF, key out.
- Ignition OFF, transmitter is out of range
- No activity exists on the serial data line.
- No outputs are commanded.
- No delay timers are actively counting.
- No wake-up inputs are present.

If all these conditions are met, the BCM will enter a low power or sleep condition.

Retained Accessory Power Description and Operation



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The body control module (BCM) monitors the ignition switch position, battery condition, and each door ajar/open switch status to determine whether the retained accessory power should be initiated or terminated. Retained accessory power is controlled by two different methods; relay control and serial data. Some modules receive a retained accessory power message from the BCM over the serial data circuits. Serial data controlled retained accessory power is deactivated as required by their modules retained accessory power mode operation. Other subsystems are activated directly by the BCM through a relay. Components and systems that are active in retained accessory power are also activated anytime the ignition is any position other than OFF regardless of the door switch signals.

Relay Controlled Retained Accessory Power

The BCM keeps the retained accessory power relay 1 and retained accessory power relay 2 energized during all power modes, except Off-Awake and Crank. The retained accessory power relay 1 and retained accessory power relay 2 are also energized for approximately 10 minutes after shutting the ignition OFF and removing the key, providing no door is opened.

Relay controlled retained accessory power will end when one of the following conditions is met:

- The BCM receives an input from any door ajar or open switch indicating the opening of any door after the ignition key is out of the ignition.

  Note: If the BCM is receiving any door ajar or open signal from those switches when the ignition key is turned OFF, retained accessory power will not initiate.

- The BCM internal timer for the retained accessory power expires after approximately 10 minutes.
- The BCM detects a decrease in battery capacity below a prescribed limit.

Systems powered by the retained accessory power relay 1 and retained accessory power relay 2 during the retained accessory power mode are as follows:

Note: The vehicle may not be equipped with all components as listed below.

- Accessory Power Receptacle
- Cigarette Lighter Receptacle
- Sunroof Control Module
- Sunroof Switch
- Sliding Rear Window Switch
- Mobile Device Wireless Charger Module

Serial Data Controlled Retained Accessory Power

Retained accessory power systems controlled by serial data are as follows:

Radio

Radio retained accessory power activation / termination is the same as relay operation with one exception; the only door switch that will turn off the radio during retained accessory power is the driver door open switch.

Vehicle Communication Interface Module (VCIM) (Onstar®) (If Equipped)

VCIM RAP activation/termination is the same as radio operation with 1 exception; if there is an active call when the ignition key is turned off the VCIM will remain in RAP mode, and keep the radio in RAP mode until the call is terminated.

Section 8

Safety and Security

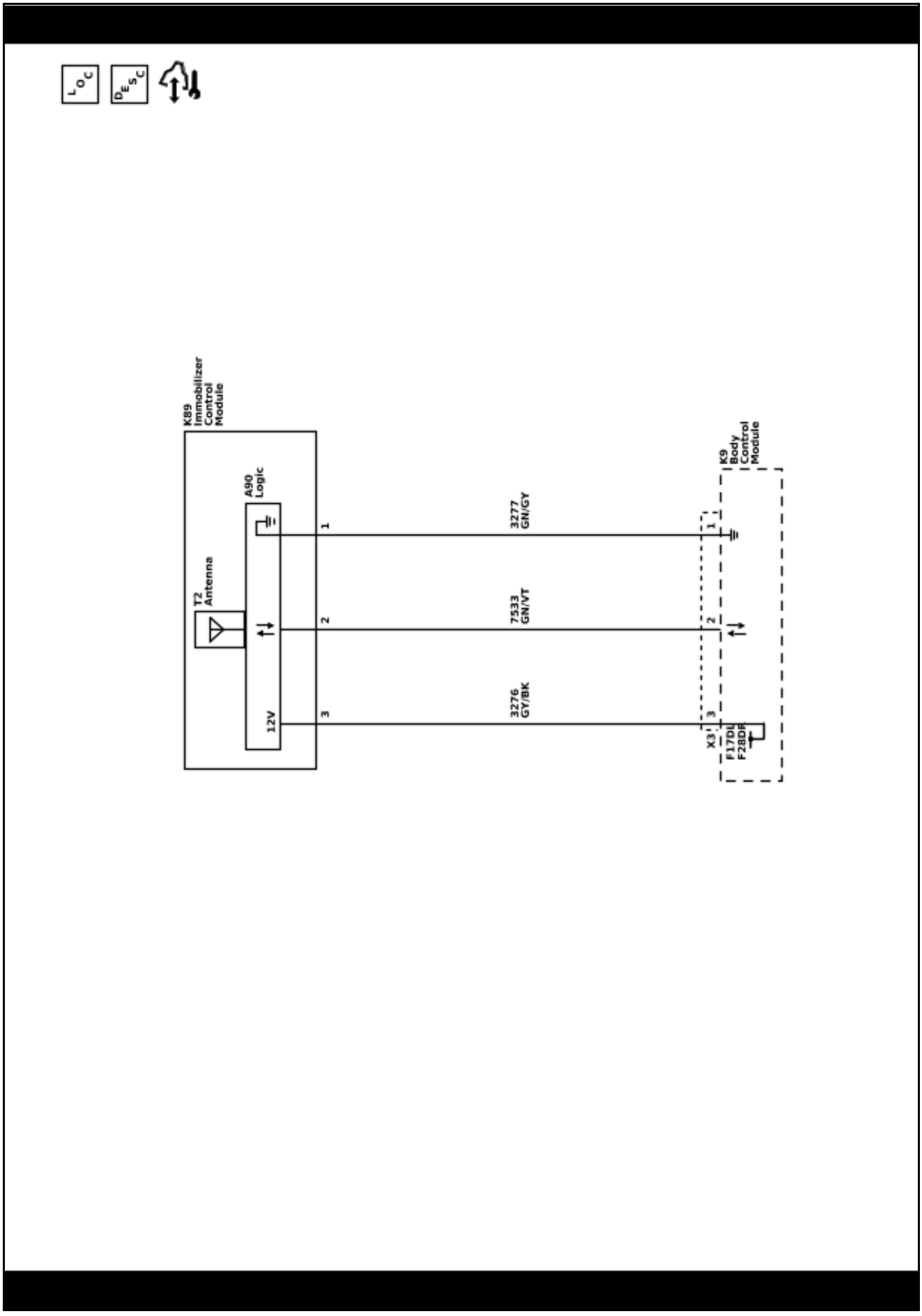
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BLANK

Immobilizer

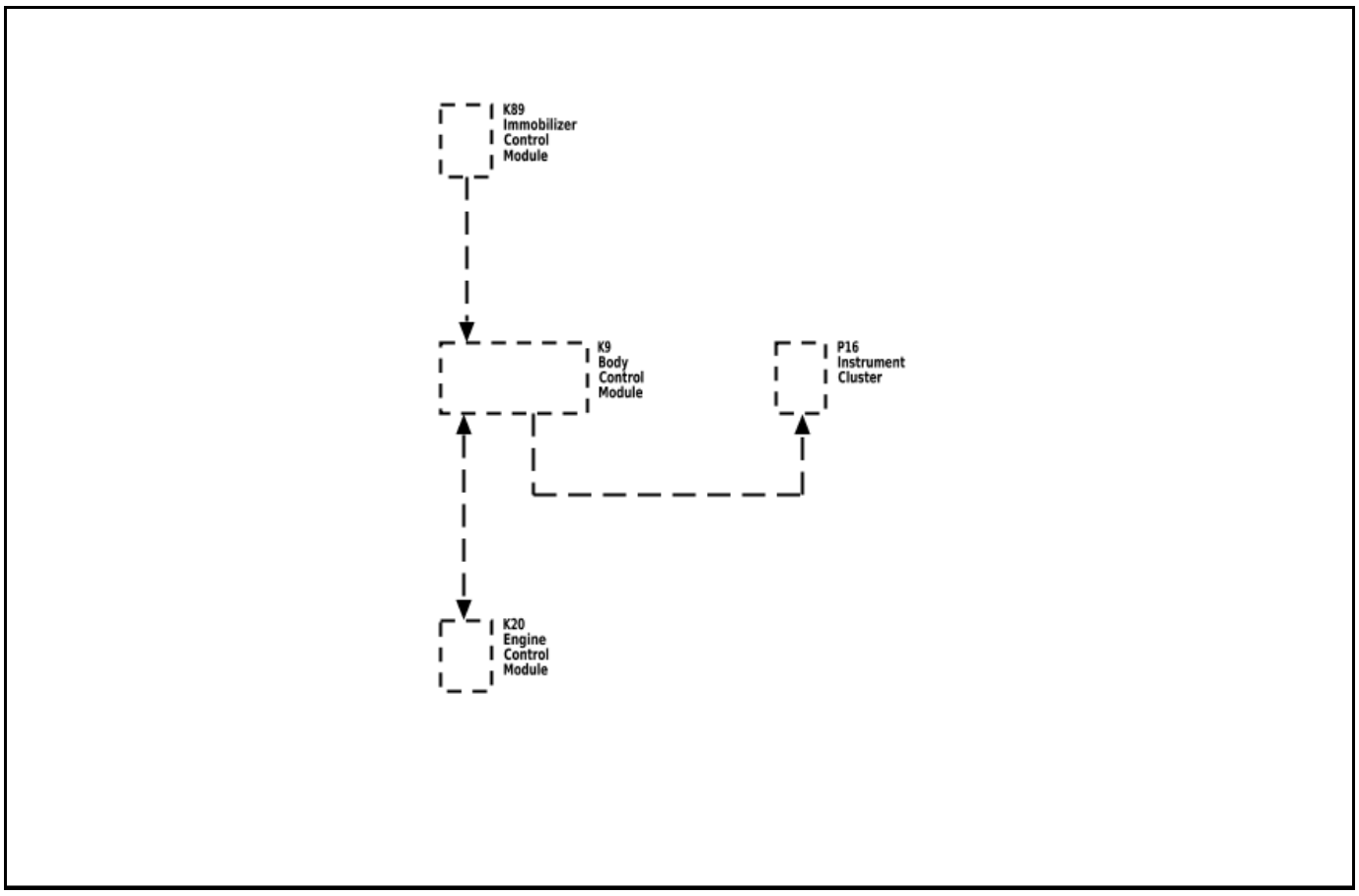
Schematic and Routing Diagrams

Immobilizer Schematics (Immobilizer)



Description and Operation

Immobilizer Description and Operation



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The immobilizer system functions are provided by the body control module (BCM) and the engine control module (ECM), as well as any control modules which store and report the environment identifier.

When an ignition key is inserted into the ignition lock cylinder and the ignition is switched ON, the transponder in the key is energized by the immobilizer coil surrounding the ignition lock cylinder. This immobilizer coil is part of the immobilizer control module. The transponder transmits a signal that contains its unique value, which is received by the BCM through the immobilizer coil. The BCM then compares this value to a value stored in memory. The BCM also monitors various control modules to determine if the stored environment identifiers match.

If both the environment identifier and the value received from the transponder match, the BCM will send the prerelease password via serial data to the ECM. If the encrypted code's unique value is incorrect or the environment identifier does not match, the BCM will send the start disable message to the ECM which will prevent the vehicle starter and fuel pump from operating.

When the ECM receives the BCM prerelease password, the ECM will challenge the password. The ECM sends this challenge to the BCM via serial data. Both the ECM and BCM perform a calculation on this challenge. If the BCM calculated response to the challenge equals the calculation performed by the ECM, the ECM will allow vehicle starting.

The components of the theft system are as follows:

- BCM
- ECM
- Immobilizer control module
- Steering column lock control module, if equipped
- Ignition key
- Security indicator
- Various control modules which store and report the environment identifier

Body Control Module (BCM)

The immobilizer system is an integral part of the BCM and is controlled internally within the BCM. The BCM can learn up to 8 keys (transponder values).

The BCM uses the following inputs:

- Environment identifier exchange with various modules
- Encrypted code from the vehicle key, received by the immobilizer control module

The BCM uses the following outputs:

- Prerelease password communication with ECM
- Challenge/response with ECM

When an ignition key is inserted into the ignition lock cylinder and the ignition is switched ON, the encrypted code in the key is energized by the immobilizer control module surrounding the ignition lock cylinder. The energized transponder transmits a signal that contains its unique value, which is received by the BCM. The BCM then compares this value to the learned key code stored in memory. The BCM then performs one of the following functions:

- If the encrypted code value matches the values stored in the BCM memory, the BCM will send the prerelease password to the ECM via serial data.
- If the encrypted code unique value does not match the value stored in the BCM, the BCM will send the start disable message to the ECM via serial data.
- If the BCM is unable to measure the ignition key encrypted code value, the BCM will not send any messages to the ECM.

Engine Control Module (ECM)

When the ECM receives the BCM prerelease password, the ECM will challenge the password. The ECM sends this challenge to the BCM via the serial data circuit. Both the ECM and BCM perform a calculation on this challenge. If the calculated response from the BCM equals the calculation performed by the ECM, the ECM will allow vehicle starting.

The ECM will disable vehicle starting if any of the following immobilization conditions occur:

- The prerelease password is invalid.
- The start disable password is sent by the BCM.
- No passwords are received. There is no communication with the BCM.
- The BCM calculated response to the challenge does not equal the calculation performed by the ECM.

Immobilizer Control Module

The immobilizer control module contains an immobilizer coil which surrounds the ignition cylinder. The coil passively powers the transponder located in the ignition key when the key is in the ignition. When powered, the key transmits its unique value to the immobilizer control module, which is then relayed to the BCM via a discrete serial data circuit. The immobilizer control module also receives B+ and ground from the BCM.

The immobilizer control module is used to:

1. Learn keys
2. To start the vehicle

Steering Column Lock Control Module

On vehicles with electronic steering column lock that use a steering column lock control module the immobilizer system will prevent vehicle starting if there is a fault or no communication with the steering column lock control module.

Ignition Key

Each ignition key contains a transponder with a unique encrypted value. The transponder's encrypted value is fixed and unable to be changed. The immobilizer system uses the ignition key transponder value to determine if a valid ignition key is being used to start the vehicle.

Environment Identifier

Various modules throughout the vehicle learn a specific environment identifier during the module programming process. The environment identifier is learned by each individual module and matches the environment identifier stored in the BCM. Prior to starting after a battery disconnect, each of the modules which store a environment identifier will compare their identifier to that of the identifier stored in the BCM. If all the identifiers match, the engine starting process will continue. If the environment identifiers do not match, engine starting will be disabled.

Security Indicator

The BCM will command the instrument cluster to illuminate the security indicator when the ignition is in the ON position to indicate a fault has occurred within the immobilizer system and when the engine starting is disabled.

Remote Vehicle Speed Limiting Description and Operation

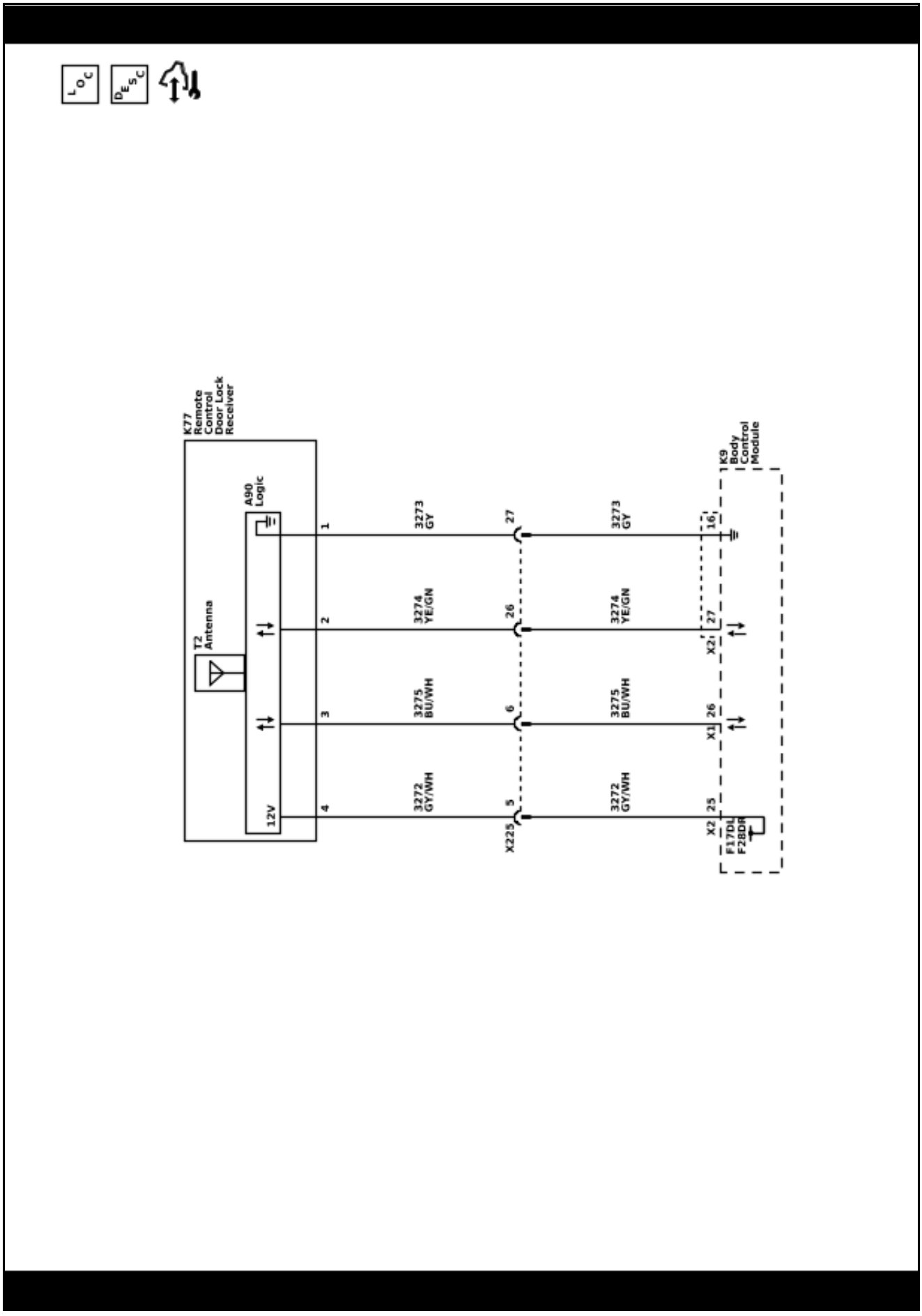
Certain vehicles equipped with OnStar® now have an additional feature that allows for remote limiting of the vehicle's speed. This OnStar® feature is called Stolen Vehicle Slow-Down and is now part of the OnStar® Stolen Vehicle Assistance service. This feature, when used in conjunction with local law enforcement and strict guidelines at the OnStar® Call Center, will slow the vehicle by interacting with the engine control system.

When the engine control system receives a valid request from the OnStar® telematics communications interface module, it will enter into a reduced engine power/vehicle speed limiting mode, which will decelerate the vehicle. Once the request is active the engine control module begins reducing engine torque to match requested vehicle speed and a REDUCED ENGINE POWER indication is displayed. No DTCs will be set during this process.

Remote Functions

Schematic and Routing Diagrams

Remote Function Schematics (Keyless Entry)



Description and Operation

Garage Door Opener Description and Operation

The garage door opener is fixed and rolling code capable. Rolling code is a system that allows the code that the customers receiver receives from the garage door opener to change every time the garage door opener is used within operating range of the receiver. Rolling code programming requires the customer to push a learn/program button on the garage door opener receiver at their home. This button is usually located on the receiver unit under a cover (light cover) on one end of the unit. The customer must follow the garage door opener manufacturers instructions to program/learn the receiver to accept the Universal Home Remote System as an authorized opener for their unit . When the receiver and the garage door opener are initially programmed together, a code is established and a new code is created for every new transmission. The software in the receiver recognizes the garage door opener and accepts the new code.

The garage door opener is compatible with most, but not all types and brands of transmitters.

The garage door opener is a transmitter operating between 288–434 MHz. The power and range of the transmitter is limited to comply with laws governing the generation of radio frequency interference. The transmitter is programmed by the user to accept the signal generated by the user's transmitters.

The garage door opener has 3 buttons that may be programmed for individual transmitter/receiver combinations to control up to 3 garage door openers, security gates, lighting systems, etc. Each button represents a transmitter code section of the transmitter, which operates separately from any other button, and may be considered a separate transmitter. Operation consists of simply pressing a button to activate the corresponding transmitter.

The garage door opener does not need any programming after it is replaced. However, for the opener function it must be programmed to the customer’s garage door or other devices such as a gate. The programming can only be performed at the device being programmed, it cannot be programmed at a service facility. Instructions for programming are listed in the Garage Door Opener Malfunction document in a Diagnostic Aid.

Note: Do not use the garage door opener (GDO) with any garage door opener that does not have the stop and reverse safety feature. This includes any garage door opener model manufactured before April 1, 1982.

Keyless Entry System Description and Operation

The keyless entry system is a vehicle entry device. The keyless entry system is used in conjunction with the door locks to unlock the vehicle. Keyless entry will lock/unlock the vehicle doors or open the rear compartment lid when a corresponding button on the keyless entry transmitter is pressed. This is accomplished by the transmitter sending a radio frequency to the Remote Control Door Lock Receiver antenna that has a direct link to the Body Control Module (BCM). The BCM interprets the signal and activates the requested function or request the appropriate control module to activate the function via a serial data message. A low transmitter battery or radio frequency interference from aftermarket devices, such as 2-way radios, power inverters, computers, etc., may cause a system malfunction. High radio frequency traffic areas, such as gas stations that use pay-at-the-pump radio frequency transponders, may also cause interference that could lead to a malfunction. Keyless entry allows you to operate the following features:

- Door lock/unlock
- Vehicle locator/Panic alarm
- Remote vehicle starting, if equipped

The keyless entry system has the following components:

- Keyless entry transmitters
- Body Control Module
- Remote Control Door Lock Receiver

Keyless Entry Transmitters

Note: When the vehicle key is in the ignition, keyless entry functions from all keyless entry transmitter are disabled.

The keyless entry transmitters are used to perform various entry functions while away from the immediate are of the vehicle. Keyless entry functions may work at up to 20 m (65 ft) away from the vehicle. Ambient conditions may affect the performance of the keyless entry transmitter and reduce the range at which keyless entry functions operate. Up to eight transmitters may be programmed to a single vehicle.

OnStar® Remote Link (if equipped)

A vehicle operator may have the ability to perform some of the keyless entry functions using applications on personal devices such as a smart phone. Unwanted or inadvertent door lock/unlock activation may be requested by the OnStar® Remote Link app. It is possible that a customer may be unaware of account usage, result in an unwanted or phantom door lock/unlock. If normal system diagnosis does results in an inability to verify the customer’s concern, contact Technical Assistance Center (TAC).

Body Control Module (BCM)

The BCM is a multifunction module that operates the keyless entry system. When an radio frequency message is received from a keyless entry transmitter, the BCM interprets this signal and performs the specific function, i.e. door lock, door unlock, or vehicle locate.

Remote Control Door Lock Receiver

The Remote Control Door Lock Receiver acts as an antenna for the keyless entry system and communicates with the BCM through a dedicated serial data link. When a button is pressed on a keyless entry transmitter, the Remote Control Door Lock Receiver receives this signal and sends the request to the BCM. The BCM interprets the signal and performs the specific function, i.e. door lock, door unlock, or vehicle locate.

Unlock Doors

Momentarily press the transmitter UNLOCK button in order to perform the following functions:

- Unlock only the driver door or all doors and liftgate (if equipped); this is customized through the DIC.
- Illuminate the interior lamps for a determined length of time or until the ignition is turned ON.
- Flash the exterior lights; this is customized through the DIC.
- Disarm the content theft deterrent system, if equipped.
- Deactivate the content theft deterrent system when in the alarm mode.

Lock All Doors

Press the transmitter LOCK button to perform the following functions:

- Lock all vehicle doors.
- Immediately turn OFF the interior lamps.
- Flash the exterior lights and/or sound the horn; this is customized through the DIC.
- Arm the content theft deterrent system.

Vehicle Locator/Panic Alarm

A single press of the panic button performs the following functions. Some functions may be dependent on personalization settings:

- Pulse the horn three times.
- Flash the exterior lamps three times.

A press and hold of the panic button performs the following functions:

- Illuminate the interior lamps.
- Pulse the horn and flash the exterior lamps for 30 seconds or until the following conditions occur:
  - The panic button is pressed.
  - The ignition switch is turned to the RUN position with a valid key.

Remote Vehicle Start, if equipped

The remote vehicle start function allows engine starting while not in the vehicle. It also allows the vehicle HVAC system and other vehicle systems to enable, providing a comfortable vehicle upon entry. The remote vehicle start sequence begins by pressing and releasing the lock button and then pressing and holding the remote vehicle start buttons on the keyless entry transmitter. The turn signal lamps will illuminate to indicate the vehicle has received the remote start request. Each time an remote vehicle start is performed, the vehicle doors are locked, however they may then be unlocked/ locked with the transmitter or vehicle key at any time. Once activated, the engine is allowed to run for 10 minutes. The remote vehicle start time may be extended by an additional 10 minutes by again pressing and releasing the lock button and then pressing and holding the remote vehicle start buttons on the transmitter. This feature is called a remote vehicle start continue and allows a maximum of 20 minutes of engine running. If the remote vehicle start continue is performed at seven minutes into the initial 10 minute time-out, a total of 17 minutes of engine running would occur. The remote vehicle start event may be suspended at any time by pressing only the remote vehicle start button on the transmitter or by entering the vehicle and pressing the hazard lamp switch.

In between ignition cycles, only two remote vehicle start events may occur or be attempted. Once two events or attempts have been made, future remote vehicle start events will be suspended until the vehicle is started using the ignition.

Hood Ajar Switch

The hood switch provides status of the hood to the BCM for remote vehicle start purposes. The switch is integrated into the hood latch assembly.

Remote Vehicle Start Circuit Description

The BCM receives a signal from the keyless entry transmitter indicating a remote vehicle start request. A message is then sent to the BCM which determines if a crank request message will be sent to the ECM to allow engine starting. To determine if conditions are correct for an remote vehicle start event, the BCM will ensure the following conditions are met:

- A valid hood ajar switch closed signal is present.
- The doors are locked.
- The hazard switch is OFF.
- The vehicle power mode is correct.
- No content theft deterrent alarm triggers are present.

When the BCM determines all conditions meet those required for an remote vehicle start event, a message is sent via serial data to the ECM. The ECM relies on the remote vehicle start message from BCM to enable remote vehicle start when the crank request signal is received. If the ECM does not receive a valid remote vehicle start message, it will not attempt to start the engine. While the ECM is in remote vehicle start mode it will suspend engine operation if any of the following additional conditions occur:

- Vehicle speed is greater than 0.
- Transmission is not in PARK.
- Excessive engine coolant temperature
- Low oil pressure
- The malfunction indicator lamp (MIL) is commanded ON.
- Engine crank time is greater than 30 seconds.
- Excessive engine speed
- Accelerator pedal position too high
- Remote start timer equals 0.
- Immobilizer system indicates tamper

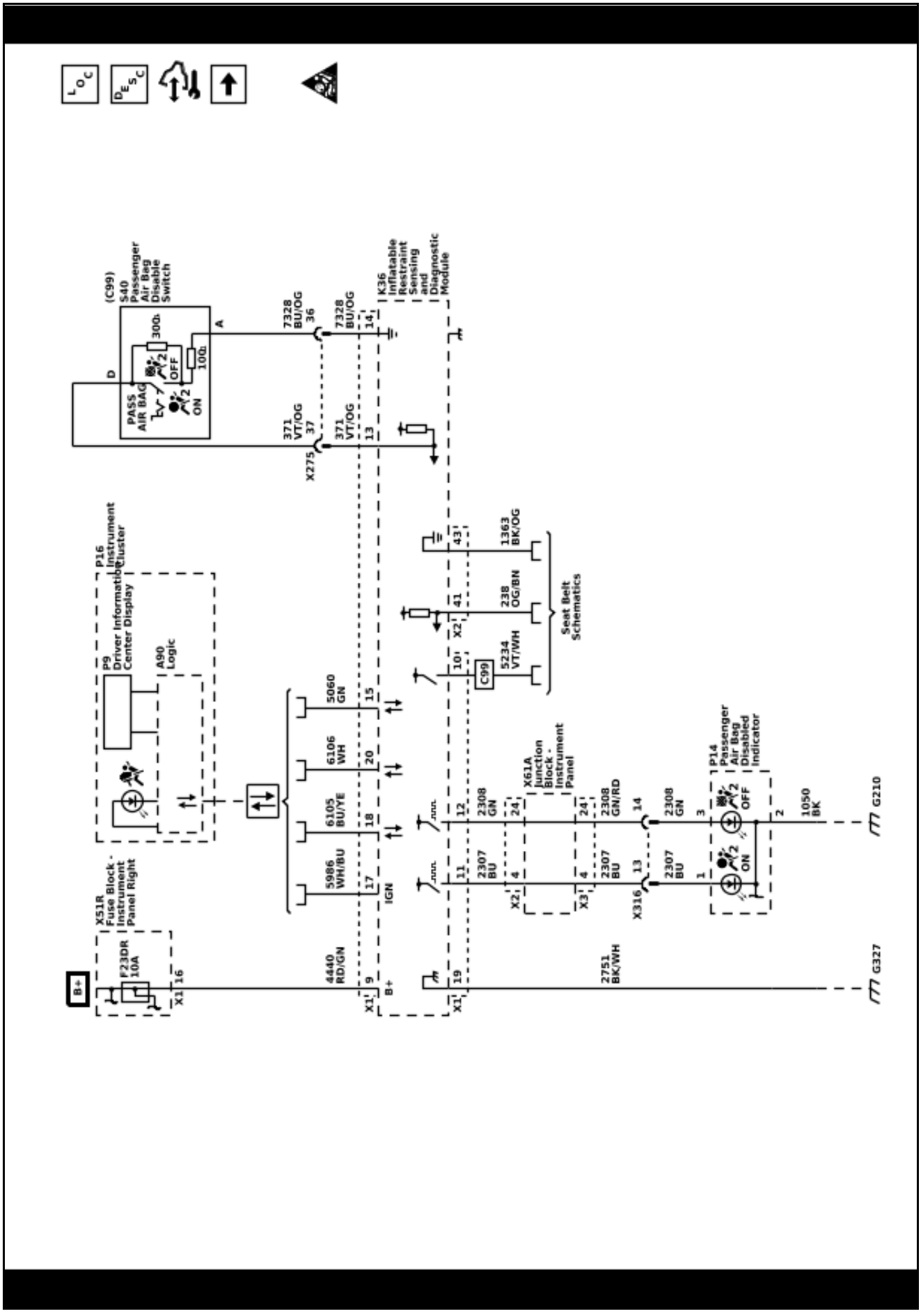
Keyless Entry Personalization

Vehicle lock/unlock functions and remote vehicle start remote vehicle start settings may be personalized. For functional descriptions and personalization instructions, refer to the vehicle owners manual.

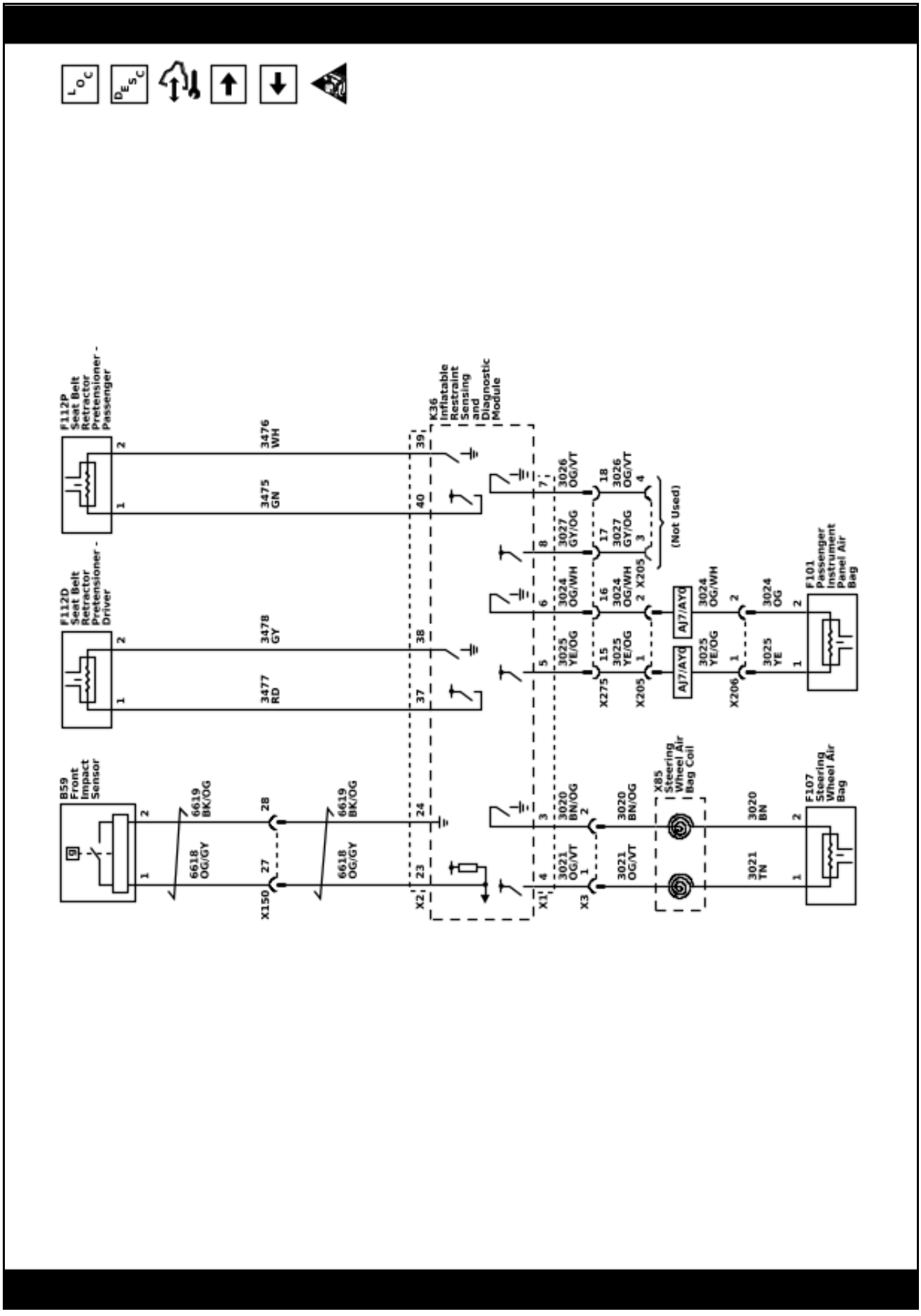
Supplemental Restraints

Schematic and Routing Diagrams

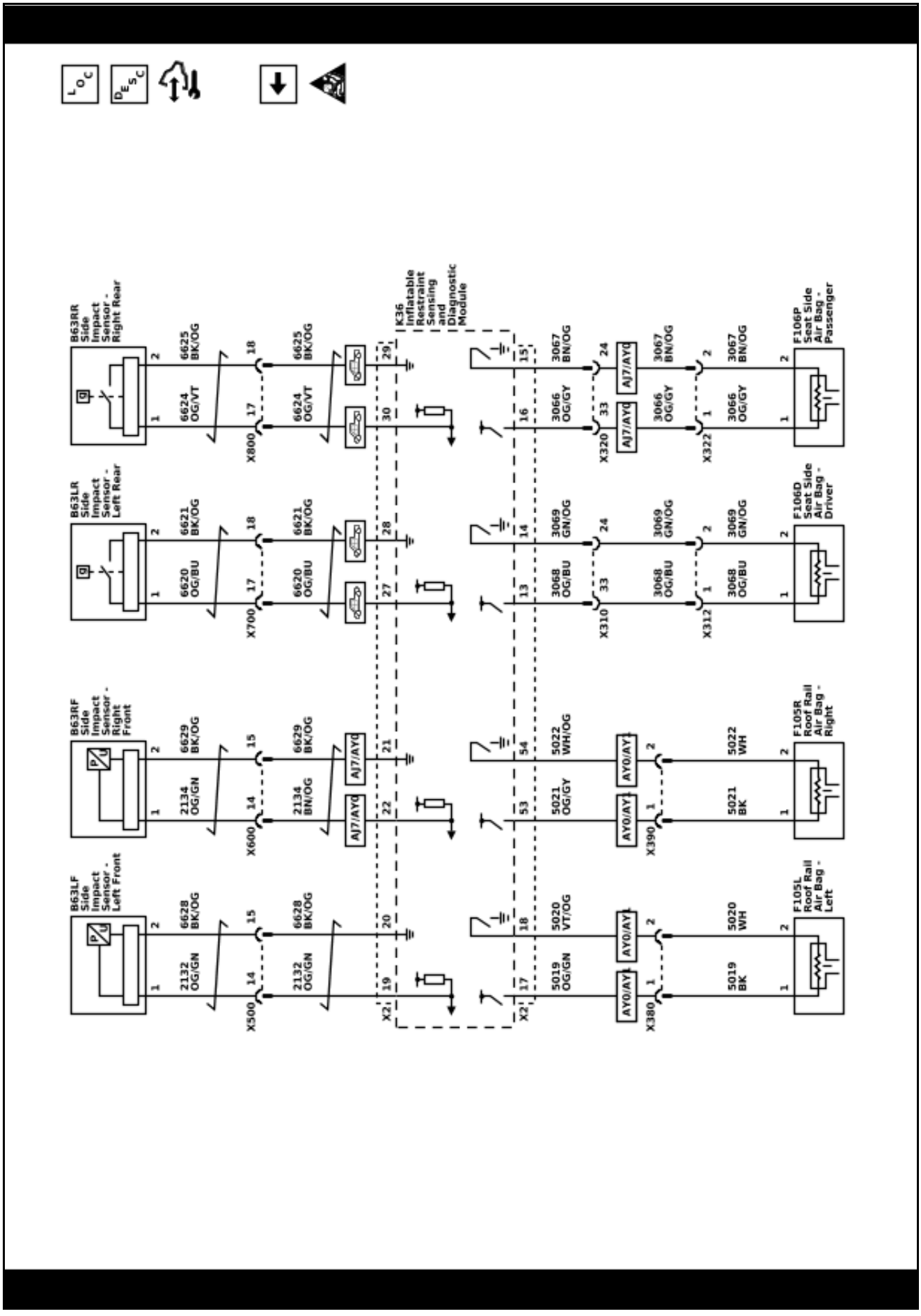
SIR Schematics (Power, Ground, Serial Data, Disable Switch and Indicators)



SIR Schematics (Frontal Impact Sensing and Deployment)



SIR Schematics (Side Impact Sensing and Deployment)



Description and Operation

Supplemental Inflatable Restraint System Description and Operation

SIR System Overview

The supplemental inflatable restraint (SIR) system supplements the protection offered by the seat belts. The SIR system contains an inflatable restraint sensing and diagnostic module (SDM), air bags, seat belt pretensioners (retractor), and impact sensor. When the inflatable restraint sensing and diagnostic module detects a collision, the inflatable restraint sensing and diagnostic module will process the information provided by the sensors to further support air bag or pretensioner deployment. The inflatable restraint sensing and diagnostic module will deploy the air bags and pretensioners if it detects a collision of sufficient force. If the force of the impact is not sufficient to warrant air bag deployment, the inflatable restraint sensing and diagnostic module may still deploy the seat belt pretensioners. The inflatable restraint sensing and diagnostic module contains a sensing device that converts vehicle velocity changes to an electrical signal. The inflatable restraint sensing and diagnostic module compares these signals to values stored in memory. If the signals exceed a stored value, the inflatable restraint sensing and diagnostic module will determine the severity of the impact and either cause current to flow through the frontal deployment loops deploying the frontal air bags and pretensioners, or it will deploy the pretensioners only. The inflatable restraint sensing and diagnostic module continuously monitors the deployment loops for malfunctions and illuminates the AIR BAG indicator if a fault is detected. The inflatable restraint sensing and diagnostic module performs continuous diagnostic monitoring of the SIR system electrical components. Upon detection of a circuit malfunction, the inflatable restraint sensing and diagnostic module will set a DTC and inform the driver by illuminating the AIR BAG indicator. The steering column and knee bolsters are designed to absorb energy and compress during frontal collisions in order to limit leg movement and decrease the chance of injury to the driver and passenger.

AIR BAG Indicator (Driver)

The AIR BAG indicator, located in the instrument cluster, is used to notify the driver of SIR system malfunctions and to verify that the inflatable restraint sensing and diagnostic module (SDM) is communicating with the instrument cluster. When the ignition is turned ON, the inflatable restraint sensing and diagnostic module is supplied with ignition positive voltage. The instrument cluster will momentarily turn on the AIR BAG indicator. While the indicator is on, the inflatable restraint sensing and diagnostic module conducts tests on all SIR system components and circuits. If no malfunctions are detected the inflatable restraint sensing and diagnostic module will communicate with the instrument cluster through the serial data circuit and command the AIR BAG indicator OFF. The inflatable restraint sensing and diagnostic module provides continuous monitoring of the air bag circuits by conducting a sequence of checks. If a malfunction is detected the inflatable restraint sensing and diagnostic module will store a diagnostic trouble code (DTC) and command the instrument cluster to illuminate the AIR BAG indicator via serial data. The presence of a SIR system malfunction could result in non-deployment of the air bags or deployment in conditions less severe than intended. The AIR BAG indicator will remain ON until the malfunction has been repaired.

Inflatable Restraint Sensing and Diagnostic Module (SDM)

The inflatable restraint sensing and diagnostic module (SDM) is a microprocessor and the control center for the supplemental inflatable restraint (SIR) system. The inflatable restraint sensing and diagnostic module contains internal sensors along with external impact sensor(s) mounted at strategic locations on the vehicle. In the event of a collision, the inflatable restraint sensing and diagnostic module compares the signals from the internal and external impact sensor(s) to a value stored in memory. When the generated signals exceed the stored value, the inflatable restraint sensing and diagnostic module will cause current to flow through the appropriate deployment loops to deploy the air bags. The inflatable restraint sensing and diagnostic module records the SIR system status when a deployment occurs and illuminates the AIR BAG indicator located in the instrument cluster. The inflatable restraint sensing and diagnostic module performs continuous diagnostic monitoring of the SIR system electrical components and circuitry when the ignition is turned ON. If the inflatable restraint sensing and diagnostic module detects a malfunction, a DTC will be stored and the inflatable restraint sensing and diagnostic module will request the instrument cluster to illuminate the AIR BAG indicator, notifying the driver that a malfunction exists. In the event that ignition positive voltage is lost during a collision, the inflatable restraint sensing and diagnostic module maintains a 23-volt loop reserve for deployment of the air bags. It is important when disabling the SIR system for servicing or rescue operations to allow the 23-volt loop reserve to dissipate, which could take up to 1 minute.

Air Bags

This vehicle contains 2 air bags. The 2 air bags are located in the steering wheel (single inflator) and instrument panel (passenger side) (single inflator). To view the locations of the air bags refer to Master Electrical Component List. Air bags contain a housing, inflatable air bag, on einitiating device, canister of gas generating material and, in some cases, stored compressed gas. The deployment loops supply current through the inflator modules to deploy the air bags. For moderate frontal collisions the air bags deploy at less than full deployment which consists of stage 1. The current passing through the air bag, ignites the material in the canister producing a rapid generation of gas and is some cases, the release of compressed gas. The gas produced from this reaction rapidly inflates the air bag. Once the air bag is inflated it quickly deflates through the air bag vent holes and/or the bag fabric. Each air bag is equipped with a shorting bar (If Equipped) located in the connectors of the module.

The shorting bar (If Equipped) shorts the air bag deployment loop circuitry to prevent unwanted deployment of the air bag when it is disconnected.

Seat Belt Pretensioners (Retractor)

The seat belt pretensioners (driver and passenger) consist of a housing, seat belt retractor (located in the B-pillar), seat belt webbing, an initiator, and a canister of gas generating materials. To view the locations of the seat belt pretentioners refer to Master Electrical Component List. The initiator is part of the seat belt pretensioner deployment loop. When the vehicle is involved in a collision of sufficient force, the inflatable restraint sensing and diagnostic module causes current to flow through the seat belt deployment loops to the initiator. Current passing through the initiator ignites the material in the canister producing a rapid generation of gas. The gas produced from this reaction deploys the seat belt pretensioners which removes all of the slack in the seat belts. Depending on the severity of the collision, the seat belt pretensioners may deploy without the frontal air bags deploying, or they will deploy immediately before the frontal air bags deploy. Each seat belt pretensioner is equipped with a shorting bar (If Equipped) that is located in the connector of the seat belt pretensioner. The shorting bar (If Equipped) shorts the seat belt pretensioner circuitry to prevent unwanted deployment of the seat belt pretensioner when the connector is disconnected.

Impact Sensors

There is one impact sensor which is located in the front of the vehicle.To view the locations of the impact sensors refer to Master Electrical Component List. The front of vehicle, the impact sensor contains a sensing device which monitors vehicle acceleration to detect collisions that are severe enough to warrant air bag deployment. The impact sensors are not part of the deployment loop, but instead provide input to the Inflatable Restraint Sensing and Diagnostic Module (SDM). The Inflatable Restraint Sensing and Diagnostic Module contains a microprocessor that performs calculations using the measured inputs from acceleration and pressure sensors. When the generated calculations exceed the stored value, the Inflatable Restraint Sensing and Diagnostic Module will cause current to flow through the deployment loops deploying the appropriate air bags.

Seat Belt Indicators

The seat belt indicators are controlled through the inflatable restraint sensing and diagnostic module (SDM). For further information on seat belt indicators refer to Seat Belt System Description and Operation.

Section 9

Transmission

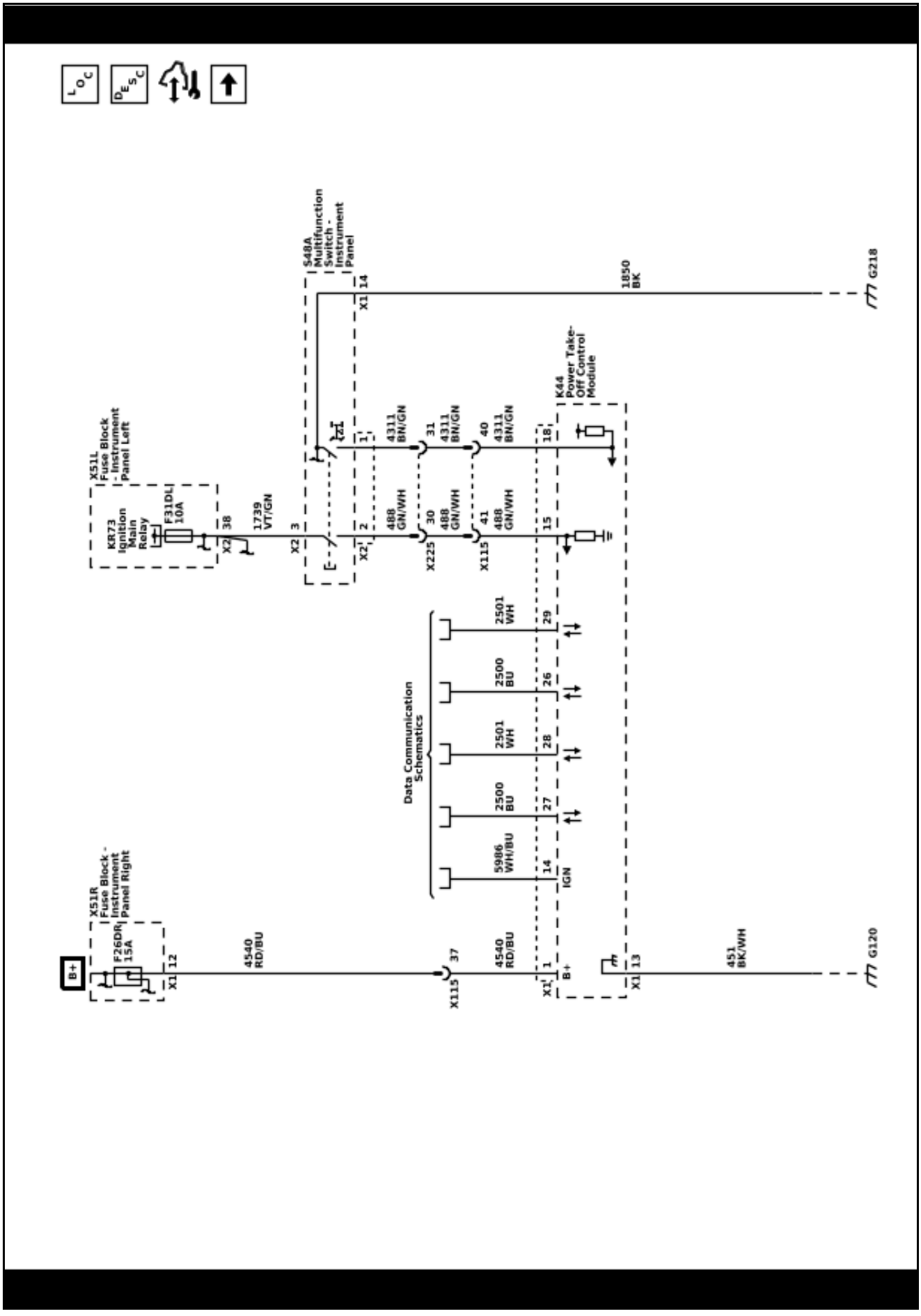
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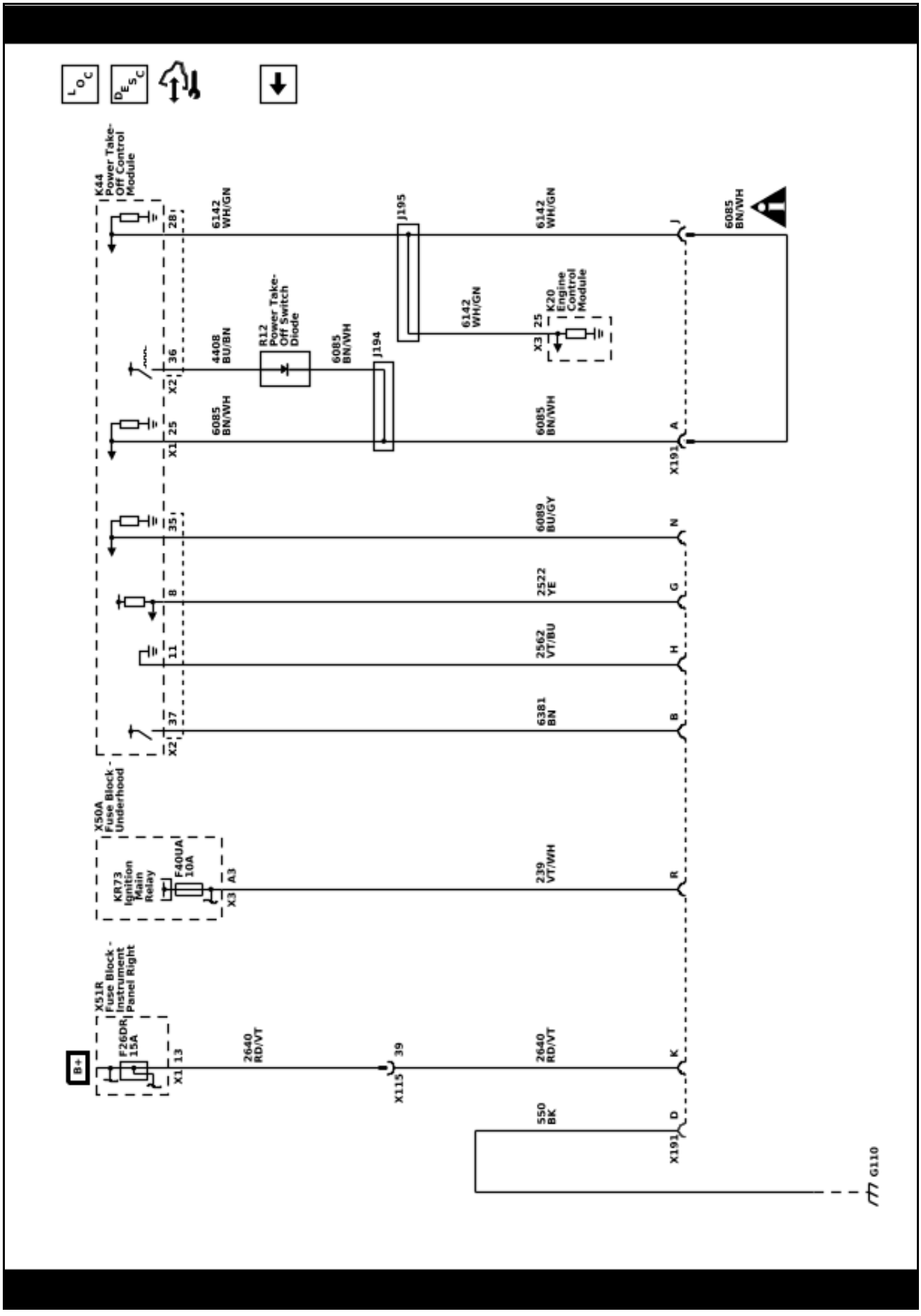
Power Take-Off

Schematic and Routing Diagrams

Power Take-Off (PTO) Schematics (Power, Ground, Serial Data and Enable (PTO))

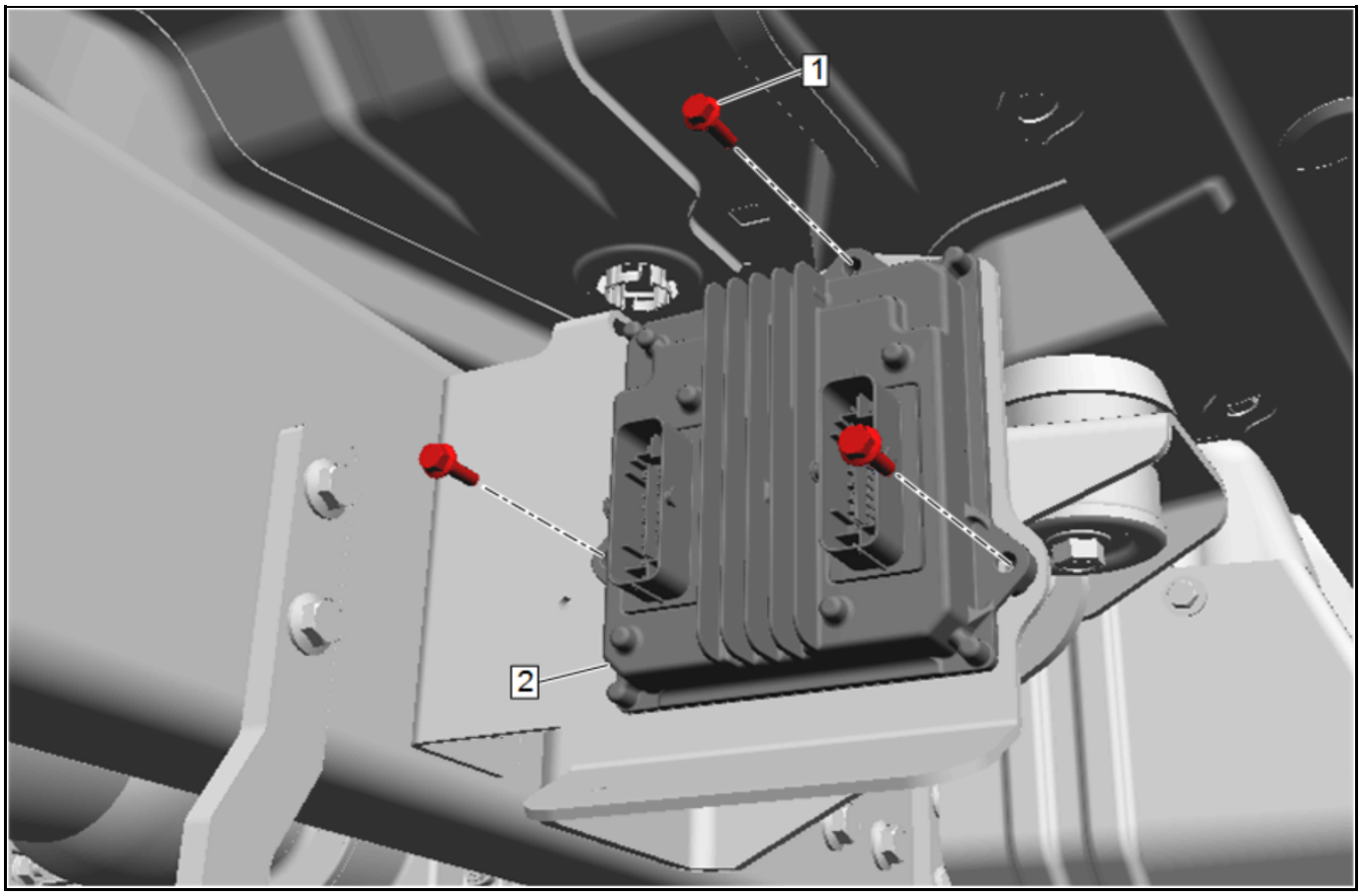


Power Take-Off (PTO) Schematics (Provisional Connector (PTO))



Repair Instructions

Power Takeoff Control Module Replacement



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Power Takeoff Control Module Replacement

Callout	Component Name
Preliminary Procedure Disconnect the electrical connectors and detach the wiring harness as necessary. **Note:** Prior to starting the replacement procedure, refer to the GDS2 PTO Copy and Restore application found in the K44 Power Take-off Control Module: Programming and Setup	
1	Engine Speed Power Take-Off Control Module Bolt [3x] **Caution:** Refer to Fastener Caution. **Tighten** 13.3 - 14.7 N•m (10 - 11 lb ft)
2	Engine Speed Power Take-Off Control Module **Procedure** NEW engine speed power take-off control module must be programed. K44 Power Take-off Control Module: Programming and Setup

Description and Operation

Power Take-Off (PTO) Description and Operation

The power take-off (PTO) is an upfitter integrated system that allows the user to create an auxiliary power source. The PTO system specifically controls engine speed to values higher than normal base idle, PTO load relay engagement, and remote starting and shutdown of the engine. When the operator requests PTO, the PTO switch will be turned ON and the engine RPM will go to a default standby speed.

The PTO system utilizes the following:

- The transmission driven PTO gear
- The in-cab PTO switch and cruise control SET – and RES + switches
- The PTO telltale indicator
- The power take off module (PTOM)
- The remote PTO upfitter connector

Note: For specific information on how to set up and operate the Power Take Off system refer to the vehicle Duramax Diesel supplement manual and the GM Upfitter website.

Factory Installed PTO Components

The in-cab PTO switch and cruise control SET – and RES + switches

The PTO switch is a part of the switch bank and is mounted in the right side of the center instrument panel. The PTO switch is a two position momentary switch with two states: ON/OFF. When the PTO switch is pressed and released to the ON position, the PTO relay will be energized by the PTOM. The cruise control SET – and RES + switches are used to control PTO desired speed. Note that the cruise control ON/OFF switch shall be set to OFF for PTO to operate.

PTO Telltale Indicator

The PTO telltale indicator is a part of the DIC message center. The PTOM shall command the state of the PTO telltale via instrument panel displays based on the following criteria:

- The telltale will illuminate, flashing at a 0.5 second interval rate when the PTO relay is energized. The indicator illuminates solid once the PTO load feedback signal confirms the load has been engaged or after 2 seconds if load feedback is not utilized by the PTO system.
- The telltale will flash at a 1 second interval rate when PTO memory speed is retained. Depressing the in-cab PTO switch to the OFF position turns the PTO system off. The PTO telltale will turn off once engine speed reaches base engine idle, at which time the PTO relay is de-energized.

Power Take-Off Module (PTOM)

- Processes PTO operator switch inputs and translates these inputs into an engine speed request to the ECM
- Controls the engagement of the PTO load relay
- Process requests to the BCM and ECM to start and shutdown the engine
- Requests the IPC to display on the DIC the actions the driver must take to enable PTO
- Requests the ECM to command an engine shutdown and engine shutdown horn warning for critical engine and transition conditions (stationary remote PTO only).

The PTOM constantly looks at the information from various sensors and other inputs, and controls the systems that affect vehicle performance. If any of the PTO engage conditions for the specific operating mode are no longer valid, the engine controller will exit out of PTO mode.

Remote PTO Upfitter Connector

The PTO upfitter connector provides access to all remote PTO functions. The connector is located on the right-hand outside frame rail, underneath the passenger side door. Electrical connections to the following components are provided by this connector. The upfitter connector pin circuits (other than battery, ignition and ground) are disabled as the vehicle is received from the factory. The PTO module must be reprogrammed by the upfitter or dealer to enable the following circuits:

- PTO remote engine arm
- PTO remote engine shutdown/start
- PTO remote set/variable speed potentiometer
- PTO lead feedback

Other Vehicle Modules

The PTO system also utilizes the following vehicle modules, which communicate over the serial data system:

- The body control module (BCM)
- The engine control module (ECM)
- The instrument panel cluster (IPC)
- The transmission control module (TCM)
- The electronic brake control module (EBCM)

Body Control Module (BCM)

The BCM maintains the PTO factory default mode, unless it is reprogrammed with a scan tool to change the PTO configuration mode. The BCM also controls the remote start/shutdown function.

Engine Control Module (ECM)

The ECM controls the engine speed and the engine starting based on messages from the PTOM through serial data. The ECM also provides PTO specific engine information to the PTOM through serial data messages.

Electronic Brake Control Module

The EBCM monitors the vehicle speed. The PTOM receives the status of the vehicle speed from the EBCM via serial data messages.

Instrument Panel Cluster (IPC)

The driver information center (DIC) of the IPC displays actions the driver must take in order to engage PTO. If the PTO will not engage, one or more of the following DIC messages may appear on the instrument panel cluster (IPC):

Stationary PTO	Mobile PTO
PTO: REDUCE VEHICLE SPEED	PTO: DISENGAGE CRUISE CONTROL
PTO: RELEASE BRAKE	PTO: REDUCE ENGINE SPEED
PTO: SET PARK BRAKE	PTO: RELEASE BRAKE
PTO: REDUCE ENGINE SPEED	PTO: PRESS and RELEASE BRAKE
PTO: SHIFT TO P OR N	PTO: REDUCE VEHICLE SPEED
PTO: DISENGAGE CRUISE CONTROL	—

Transmission Control Module (TCM)

The TCM adjusts shift patterns to minimize shifting during PTO operation. The TCM also provides transmission gear states and temperature conditions to the PTOM via serial data messages.

Electronic Brake Control Module (EBCM)

The EBCM disables the PTO if wheel speed pulses are larger than calibratable values. The EBCM also disengages the PTO during a traction control event.

PTO Enable Conditions

Stationary PTO

The following conditions must be met in order to engage stationary PTO:

- The engine must be running.
- The vehicle cannot be moving and the parking brake must be set.
- The shift lever must be in PARK (P) or NEUTRAL (N).
- The brake pedal must not be pressed.
- Cruise control must be OFF.

In-cab PTO operation: Press and release the in–cab PTO switch to the ON position. The PTO telltale indicator will flash fast until the PTO load becomes engaged. When the load becomes engaged, the telltale indicator will stop flashing and stay illuminated. The cruise control SET – and RES + switch positions can then be used to establish the desired PTO operating speed.

Remote PTO operation: Press and release the PTO remote arm switch, then within five seconds, press and release the PTO remote engine start/shutdown switch. The remote PTO indicator light will illuminate when the PTO load is engaged. The PTO remote SET or PTO remote variable speed switches can then be used to establish the desired PTO operating speed. These switches are accessed through the PTO upfitter connector, located under the passenger side door.

Mobile PTO

The following conditions must be met prior to engaging mobile PTO:

- The engine must be running.
- The vehicle speed must be less than the PTO top vehicle speed limit. The default setting is 94 km/h (58 mph). This limit can be adjusted.
- The shift lever must be in M1, M2 or M3.
- The brake must be pressed and then released. The brake must then remain released.
- Cruise control must be OFF.
- Engine speed must be less than the maximum allowed PTO engage speed of 1500 RPM.

Press and release the PTO in-cab switch to the ON position. The PTO telltale will flash fast until the PTO load becomes engaged. When the load becomes engaged, the telltale will stop flashing and stay illuminated. The SET – and RES + switches can then be used to establish the desired PTO operating speed.

PTO Disengage Conditions

Stationary PTO

The stationary PTO mode will disengage if any of the following conditions are detected by the vehicle modules:

- Vehicle movement
- The park brake is released
- The transmission is shifted from PARK (P) to DRIVE (D) or REVERSE (R).
- The PTO load becomes disengaged
- A press and release of the PTO in–cab switch to the OFF position.
- A press and release of the PTO remote engine start/shutdown switch (stationary remote PTO only).
- A press and release of the PTO E-STOP switch (stationary remote PTO only).

Mobile PTO

The mobile PTO mode will also disengage if the following conditions are detected by the vehicle modules:

- A press of the brake pedal
- Vehicle speed exceeds 94 km/h (58 mph)
- Engine speed exceeds the maximum allowed PTO operating speed of 2100 RPM
- The PTO load becomes disengaged
- A press and release of the PTO in–cab switch to the OFF position

The PTO control system will attempt to limit accelerator pedal and PTO switch input as the vehicle approaches the above operational limits. There are some vehicle conditions, such as down hill acceleration, which may cause vehicle speed or engine speed limits to be exceeded. Under those conditions, PTO is disengaged.

Modes of Operation

Preset PTO Mode

Preset PTO can only be used when the vehicle is not moving. The engine speed is initially set to a standby engine speed of 900 RPM. This provides an initial start-up engine speed to match the engagement of the PTO load. The PTO standby engine speed can be reprogrammed to higher speeds.

Choose one of two presets by pressing and releasing the cruise control SET – /RES + or PTO remote set switches:

- Speed 1: Pressing the cruise control SET — or PTO Remote Set 1 switch results in a preset speed of 1200 RPM.
- Speed 2: Pressing the cruise control RES + or PTO Remote Set 2 switch results in a preset speed of 1900 RPM

Pressing and releasing the PTO in-cab switch or PTO remote engine start/shutdown switch to the OFF position results in the return of the engine speed back to normal idle. The PTO load relay is also disengaged.

Maximum PTO Operating Speed: To protect the PTO from overspeed, the PTO system will disengage when the engine speed exceeds 3100 RPM.

The Stationary PTO Mode provides both in-cab and remote controls. The in-cab controls are enabled as the factory preset. The remote controls are disabled. This factory preset configuration can be reprogrammed to enable the remote controls, and disable the in-cab PTO controls.

Note: DO NOT enable/activate PTO during service (hoist) conditions at any time

Variable PTO Mode

In this mode, the vehicle can be programmed for stationary or mobile operation.

The variable PTO mode controls engine speed and PTO load engagement and is selected by either the PTO in-cab or remote switches. Engine speed selection is variable between base engine idle speed and a maximum of 3100 RPM.

In the mobile PTO mode, the vehicle will operate at a vehicle speed resulting from the current PTO engine speed request and current transmission gear range selected.

Vehicle speed stability is greatly improved by shifting into the transmission manual mode because upshifts are limited. This reduces the maximum vehicle speed while allowing high engine speed operation. Therefore, low vehicle speed operation, 16–40 km/h (10–25 mph) and high PTO engine speed 1500–2000 RPM can be achieved in the manual mode 1 and 2 transmission ranges.

In-cab PTO Switch Operation:

- ON: Press and release the PTO in-cab switch to the ON position to engage PTO. The PTOM will increase the engine speed to the factory preset engine speed. The initial standby speed can be adjusted by holding the accelerator to the desired engine speed, then pressing and releasing the ON switch. The current engine speed will become the new standby speed. This adjustment can only be done once at the initial engagement of the PTO, and the initial standby speed adjustment must be between the engine base idle speed and the maximum PTO engine speed.
- OFF: Press and release the PTO in-cab switch to the OFF position to disengage PTO. The engine speed will return to the base idle speed and the PTO load relay will be disengaged.

Cruise Control SET– and RES+ Switch Operation:

- SET —: Press and hold the accelerator to obtain the desired engine speed, then press and release the SET – switch. The current engine speed will be maintained. This action can be repeated as desired to a higher RPM value. The PTO set speed cannot exceed 3100 RPM.
  - – Tap Down: Press and release the SET – switch to reduce the engine speed by increments of 100 RPM.
  - – Coast: Press and hold the SET – switch to reduce the RPM by 150 RPM per second until the desired engine speed is reached or until the initial PTO standby speed is reached.
- RES +: When a PTO set speed has been achieved, press and release the brake pedal. Engine speed will return to normal idle speed. The PTO telltale will flash slowly indicating the previous PTO set speed has been retained in memory. Press and release the RES + to resume the previous PTO set speed. The PTO set speed cannot exceed 3100 RPM.
  - – Tap Up: Press and release the RES + to increase the engine speed by increments of 100 RPM.
  - – Accelerate: Press and hold the RES + to increase the RPM by 150 RPM per second until the desired engine speed is reached or until the maximum allowable PTO set speed is reached.

PTO State	Applied Switch	Short Apply	Long Apply
PTO STANDBY ENABLED	RES +	Tap Up (Engaged)	Accelerate (Engaged)
PTO STANDBY ENABLED	SET −	Engaged	Engaged
PTO ENGAGED (RPM already higher than standby)	SET –	Tap Down	Coast
PTO ENGAGED (RPM already lower than maximum speed)	RES +	Tap Up	Accelerate
STANDBY DISABLED with no memory speed	RES +	No Action	No Action
STANDBY DISABLED with a memory speed	RES +	Resume	Resume
STANDBY ENABLED with no memory speed	RES +	Tap Up (Engaged)	Resume
STANDBY ENABLED with a memory speed	RES +	Resume	Resume

Remote Engine Start Control

The PTO system allows the engine to be remotely started while operating in the stationary PTO mode. The wiring system provides for connections to a remote engine start arming switch and remote start/shutdownn switch. These connections are accessed through the upfitter connector.

The remote start function is initiated by a sequence of switch actions, in addition to several vehicle conditions. The following conditions must be met before attempting to remote start the engine. The vehicle ignition key can be in any position or removed from the ignition:

- The vehicle must be configured for stationary PTO operation.
- The parking brake must be set.
- The transmission must be in PARK (P).
- The hood must be closed.

Once the above conditions are met, to continue with the remote start, use the remote PTO controls to do the following:

1. Press and release the PTO remote arm switch.
2. Within five seconds of releasing the PTO remote arm switch, press and release the PTO remote engine start/shutdown switch until the engine starts.

The PTO system will then elevate engine RPM to standby speed and engage the PTO load. Use the PTO remote set or PTO remote variable speed switches (based on configuration) to elevate PTO speed to the desired engine operating speed.

Remote Engine Shutdown Control

The PTO system allows for remote engine shutdown while operating in the stationary PTO mode. This feature has the following functions:

- Engine shutdown using the operator remote switch: The vehicle wiring system provides remote engine shutdown switch connections, which can be accessed through the PTO upfitter connector.
- Timed auto-engine shutdown: The timed auto-engine shutdown feature provides the means to shut down the engine automatically after a predefined time. PTO must be operational for this function to be active.
- Engine shutdown based on critical engine conditions: The engine can be shutdown when PTO is operating if a critical engine condition is detected by the vehicle system (i.e., low oil, low oil pressure, hot engine, hot transmission, low fuel).
- Emergency engine shutdown: The vehicle wiring system supports remote Emergency engine shutdown via application of the E-STOP switch located at the external (upfitter’s) panel accessible through the PTO upfitter connector. (e.g. when PTO relay is stuck closed in Stationary Remote mode, operator shall activate E—STOP switch to shutdown engine and allow engine to be restarted at the next ignition cycle without PTO system activation.

PTO Factory Default Settings

Power Take-Off (PTO) Description and Operation

Function	Value/Default Setting	Scan Tool/HMI Customization Menu
PTO Option	None Preset (Default) Variable Mobile	Scan Tool
PTO In-Cab Control	Enabled Disabled	Scan Tool
PTO Remote Control Status	Enabled Disabled (Default)	Scan Tool
PTO Ramp Rate	4 – 150 RPM/sec	Scan Tool
PTO Set 1 Speed	500 – 3100 RPM 1200 RPM (default)	HMI Customization Display/Scan Tool
PTO Set 2 Speed	500 – 3100 RPM 1900 RPM (default)	HMI Customization Display/Scan Tool
PTO Relay	Yes (default) No	Scan Tool
PTO Feedback	Yes (default) No	Scan Tool
Fuel Level for Engine Shutdown	0 – 25% fuel level 15% fuel level	Scan Tool
PTO to Set 1 Speed	Yes No (default)	Scan Tool
PTO Remote Engine Start	Yes No (default)	Scan Tool
PTO Remote Set Switch	Yes No (default)	Scan Tool
PTO Remote Set Switch Type	Momentary (default) Latching	Scan Tool
PTO Remote Engine Shutdown	Yes No (default)	Scan Tool
Remote Set Switch Low = (less than 33% of Ignition voltage)	PTO Standby Set 1 (default) Set 2	Scan Tool
Remote Set Switch High + (33% to 66% of Ignition voltage)	PTO Standby Set 1 Set 2 (default)	Scan Tool
Remote Set Switch Open = (greater than 66% ignition voltage)	PTO Standby Set 1 (default) Set 2	Scan Tool
PTO Maximum Engage Speed	0 – 1500 RPM 1500 RPM (default)	Scan Tool
PTO Maximum Engine Speed	500 — 3100 RPM 2100 RPM (default)	Scan Tool
PTO Standby Speed	500 — 1500 RPM 900 RPM (default)	HMI Customization Display/Scan Tool
Engine Run Timer	0 — 1320 minutes	HMI Customization Display/Scan Tool
Chirp Before Start	Enabled (default) Disabled	Scan Tool

Power Take-Off (PTO) Description and Operation (cont'd)

Function	Value/Default Setting	Scan Tool/HMI Customization Menu
PTO Tap Step	4 – 500 RPM/Step 100 RPM/Step (default)	HMI Customization Display/Scan Tool
Brake Release Action	Standby Idle Speed (default)	Scan Tool
Remote PTO Variable Speed Switch	Yes No (default)	Scan Tool
PTO ON During Braking	Yes (default) No	Scan Tool
Maximum Vehicle Speed	30 kph (19 mph) to 94 kph (58 mph) 94 kph ((58 mph) (default)	Scan Tool
PTO Minimum Remote Variable Speed	0 – 50% 2% (default)	Scan Tool
PTO Maximum Remote Variable Speed	50 – 100% 95% (default)	Scan Tool
Engine Shutdown Enable	Yes No (default)	Scan Tool
PTO Accelerator Lockout	Enabled Disabled (default)	Scan Tool

Reprogramming the PTOM for Fast Idle/ PTO Using the Scan Tool

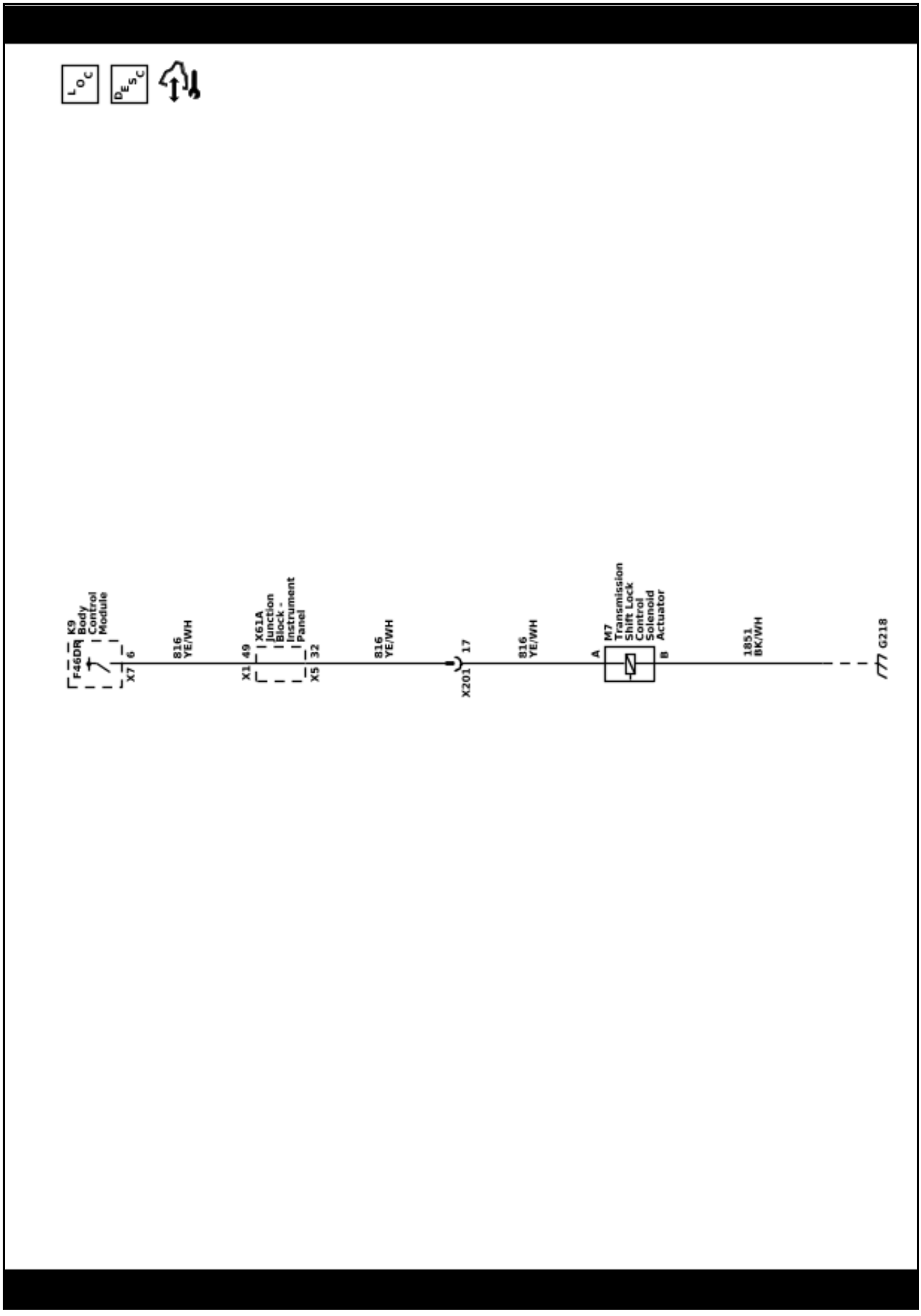
A scan tool must be used to enable certain PTO options and also to adjust the factory preset parameters to the desired settings.

For additional scan tool information, refer to Control Module References.

Shift Lock Control

Schematic and Routing Diagrams

Shift Lock Control Schematics (Shift Lock Control)



Description and Operation

Automatic Transmission Shift Lock Control Description and Operation

The Automatic Transmission Shift Lock Control System is a safety device that prevents an inadvertent shift out of PARK when the engine is running. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consists of the following components:

- The Automatic Transmission Shift Lock Solenoid (serviced as the Automatic Transmission Shift Lock Actuator)
- The Body Control Module (BCM)
- The Engine Control Module (ECM)

The BCM controls the voltage to the shift lock control solenoid though the shift lock control solenoid controlled voltage circuit. The following conditions must be met before the BCM will supply voltage to the shift lock control solenoid:

- The ignition is in the ON position.
- The ECM sends an input via GMLAN serial data to the BCM when the Transmission Control Module (TCM) indicates the transmission is in the PARK position.
- The BCM receives a brake applied input from the stop lamp switch.

Since the shift lock control solenoid is permanently grounded, the BCM supplies voltage to the automatic transmission shift lock control solenoid, releasing the mechanical lock on the shift lever as the solenoid energizes. The energized solenoid allows the driver to move the shift lever out of the PARK position. When the brake pedal is not applied, the BCM turns the control voltage output of the shift lock control solenoid OFF, de-energizing the shift lock control solenoid. When the transmission is in the PARK position, the de-energized shift lock control solenoid will prevent shifting as the lever is mechanically locked in the PARK position.

During remote start operation the BCM will de-energize the automatic transmission shift lock control circuit, locking the shift lever in the PARK position

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B

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